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THIRD BIENNIAL REPORT

[No. 14 in Series]

OF

THE BOARD OF REGENTS

OF

THE UNIVERSITY OF MINNESOTA,

TO THE GOVERNOR,

FOR THE

FISCAL YEARS 1883 AND 1884, ENDING JULY 31ST.

Univ. of Min.

TRANSMITTED TO THE LEGISLATURE AT THE TWENTY-FOURTH
(THIRD BIENNIAL) SESSION, 1884.

ST. PAUL, MINN:
The Pioneer Press Company

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ASTOR, LENOX AND
TILDEN FOUNDATIONS.
1898.

The present University "charter" was enacted by the legislature February 18, 1868. The first annual report was that for 1868, transmitted to the legislature of 1869. The last annual report was that for 1878. There have been accordingly eleven annual reports, and this third biennial report is No. 14 of the series.

The annual reports of progress of the GEOLOGICAL SURVEY of Minnesota will be found in the annual reports of the Board of Regents, beginning 1872. The annual report of the survey for 1881 was printed separately, no other reports of or to the board

THE UNIVERSITY OF MINNESOTA,
OFFICE OF THE BOARD OF REGENTS,
December 31, 1884.

SIR: In compliance with law I have the honor to forward herewith the third biennial report of the Board of Regents for the fiscal years 1883 and 1884, ending July 31st.

Very respectfully,
Your obedient servant,
HENRY H. SIBLEY,
President.

To the Hon. LUCIUS F. HUBBARD,
Governor of Minnesota.

THE BOARD OF REGENTS.

The Board of Regents is composed at this date of the following gentlemen:

The Hon. GREENLEAF CLARK, M. A., St. Paul; term expires in	1886
The Hon. CUSHMAN K. DAVIS, St. Paul; term expires in	1886
The Hon. JOHN B. GILFILLAN, Minneapolis; term expires in	1887
The Hon. KNUTE NELSON, Alexandria; term expires in	1887
The Hon. JOHN S. PILLSBURY, Minneapolis; term expires in	1887
The Hon. HENRY H. SIBLEY, St. Paul; term expires in	1885
The Hon. THOS. S. BUCKHAM, M. A., Faribault; term expires in	1885

AND EX-OFFICIO,

The Hon. LUCIUS F. HUBBARD, St. Paul,
The Governor of the State.
The Hon. DAVID L. KIEHLE, M. A., Minneapolis,
The State Superintendent of Public Instruction.
WILLIAM W. FOLWELL, LL.D., Minneapolis,
The President of the University.

OFFICERS OF THE BOARD.

The Hon. HENRY H. SIBLEY, President.
The Hon. J. B. GILFILLAN, Recording Secretary.
WILLIAM W. FOLWELL, Corresponding Secretary.
R. A. DAVISON, Treasurer.

EXECUTIVE COMMITTEE.

The Hon. JOHN S. PILLSBURY.
The Hon. JOHN B. GILFILLAN.
The Hon. GREENLEAF CLARK.
The Hon. D. L. KIEHLE.

AUDITING COMMITTEE.

The Hon. GREENLEAF CLARK.
The Hon. THOMAS S. BUCKHAM.

MEETINGS.

The annual meeting is fixed by the charter for the second Tuesday in December. There is a meeting on Commencement Day; other meetings occur as called by the president of the board.

The executive committee meet regularly on one of the last secular days of each month.

The following changes have taken place in the corps of instructors since the last biennial report:

On July 11, 1883, Professor Moses Marston, Ph. D., died from the effects of an accidental injury.

Capt. E. C. Bowen, U. S. A., Professor of Military Science, resigned his office in March, 1883.

Instructor Wm. A. Noyce, Ph. D., Assistant in Chemical Laboratory, resigned in June, 1883.

Professor John S. Clark, B. A., Assistant Professor of Latin, was granted in June, 1883, a leave of absence for two years for the study of his specialty in foreign universities.

Professor Alexander T. Ormond resigned the professorship of Mental and Moral Philosophy and History at the close of the year, 1882-83.

On Feb. 24, 1883, President Wm. W. Folwell, LL. D., after a faithful and arduous service of fourteen years, during the organization and establishment of the University, resigned his office, to take effect at the close of the passing year.

On March 8, following, the resignation was accepted, to take effect when his successor should be elected and qualified.

In undertaking the responsible duty of filling the position of President of the University made vacant by the resignation of Dr. Folwell, the board appointed a committee with instructions that by correspondence and by visitation they make every effort to find and to secure a man thoroughly fitted to discharge the duties of this position.

After much time and pains, the committee selected and recommended as in every way qualified for the position of President of the University, Professor Cyrus Northrop, of Yale College.

The report was accepted and Professor Northrop was unanimously elected to assume the duties of President at the beginning of the scholastic year, September, 1884.

There were also added to the corps of instructors —

Professor O. J. Breda, Ph. D., for the Chair of Scandinavian Languages and Literature, in conformity with the act of legislature passed in 1883.

In March, 1884, Rev. George Edwin MacLean, Ph. D., was employed to give instruction in the Department of English Language and Literature.

THE GENERAL FACULTY.

The membership of the general faculty at the present time is as follows:

WILLIAM W. FOLWELL, LL. D., PRESIDENT,
Instructor in Political Science.

JABEZ BROOKS, D. D.,
Professor of Greek, and in charge of Latin.

NEWTON H. WINCHELL, M. A., PROF. GEOL. AND MIN.,
State Geologist.

CHARLES N. HEWITT, M. D.,
Professor of Preventive Medicine.

JOHN G. MOORE, B. A.,
Professor of German.

CHRISTOPHER W. HALL, M. A.,
Professor of Geology, Mineralogy and Biology.

JOHN C. HUTCHINSON, B. A.,
Assistant Professor of Greek and Mathematics.

JOHN S. CLARK, B. A.,
Assistant Professor of Latin.

MATILDA J. WILKIN, B. L.,
Instructor in English and German.

MARIA L. SANFORD,
Professor of Rhetoric and Elocution.

WILLIAM A. PIKE, C. E.,
Professor of Engineering, and in charge of Physics.

JOHN F. DOWNEY, M. A., C. E.,
Professor of Mathematics and Astronomy.

JAMES A. DODGE, PH. D.,
Professor of Chemistry.

CHARLES W. BENTON, B. A.,
Professor of French.

EDWARD D. PORTER, M. A.,
Professor of Agriculture.

WILBUR F. DECKER, B. M. E.,
Instructor in Shop Work, Drawing and Physics.

HENRY M. WAITT, B. S.,
Instructor in Engineering.

FRANKLIN STAPLES, M. D.,
Professor of the Practice of Medicine.

DANIEL W. HAND, M. D.,
Professor of Surgery.

WILLIAM H. LEONARD, M. D.,
Professor of Obstetrics and Diseases of Women and Children.

PERRY H. MILLARD, M. D.,
Professor of Anatomy and Physiology.

CLARENCE L. HERRICK, B. S.,
Instructor in Zoology.

THOMAS PEEBLES, B. A.,
Instructor in Mental and Moral Philosophy and History.

O. J. BREDA, PH. D.,
Professor of Scandinavian Languages.

GEORGE EDWIN MACLEAN, PH. D.,
Professor of English.

CHARLES E. SMITH, M. D.,
Professor of Materia Medica and Therapeutics.

GEORGE W. WOOD, M. D.,
Professor of Diseases of the Nervous System and of Medical Jurisprudence.

CHARLES SIMPSON, M. D.,
Professor of Pathology.

The financial condition of the University, as obtained from the records of the State Auditor, is as follows:

1. The Permanent University Fund has been increased as follows:

In 1883	$36,378.20
In 1884	64,752.51
Total increase	$101,130.71

Making the present amount of that fund $662,788.30.

2. The revenue from this fund which is named the General University fund, has been

For the eight months ending July 31, 1883	$53,829.57
To which is to be added a balance of	12,499.98
Making an aggregate of	$66,329.55
For the year ending July 31, 1884	46,435.12
Total for one year and eight months	$112,764.67

The disbursements for this time have been as follows:

To July 31, 1883.		
Support of University	$46,091.67	
Fees of county treasurer	124.84	
Total		$46,216.51
To July 31, 1884.		
Support of University	$59,706.83	
Accrued interest on bonds bought	193.87	
Fees of county treasurer	173.85	
Total		60,074,55
Leaving a balance on hand of		6,473.61
		$112,764.67

3. The fund styled Enlargement of University Campus, es-

tablished by law of 1879, appropriating $20,000 to the purpose named, has been drawn and expended as follows:

In 1883	$12,000.00
In 1884	8,000.00
	$20,000.00

4. By statute of 1881, $46,000 was set apart from the State Institutions Fund for the support of the University. Of this amount $33,000 was drawn to July 31, 1884, leaving at the date of this report a balance of $13,000.

5. By statute of 1879, $4,000 was set apart for the purchase of furniture and apparatus. Of this fund nothing has been drawn.

6. By statute of 1881 a fund for the erection of buildings was set apart—$30,000 for each of the years 1881, 1882, 1883, 1884 and 1885. Of this appropriation that of 1881 has been drawn, and of that of 1882, $9,000 has been drawn, leaving a balance of $12,000 of the appropriation of 1882, and the entire appropriations of 1883, 1884 and 1885 still to be drawn.

7. There remains the fund derived from the sale of the salt lands, the proceeds of which are appropriated to the support of the geological survey of the State. This fund is in the control of the Board of Regents, and will be reported in detail by the committee of the board.

THE GEOLOGICAL SURVEY.

The progress of the work of the geological survey has been satisfactory, and as rapid as the limited means and men employed would permit. The principal event of interest has been the completion and publication of the first volume of the final report, which will be laid before the legislature at its next session (1885). This should be distributed generously to parties who deserve it, and to all public libraries in the State, but it is evident that if no restriction be placed on its distribution, the edition will be at once exhausted. The value of the book to the State and to the University is attested by the unprecedented demand which has already been made for it. Another volume of similar character is nearly ready for publication, and also one on the ornithology and mammology of the State.

INSTRUCTION.

The prosperity of the University appears in the progress of its several departments. For the particulars of attendance, graduations and character of work done, reference is made to the accompanying reports of departments.

CONCLUSION.

In concluding this report the board desire to express to the legislature their full confidence in the full and firm establishment of the university in all its relations and departments. In its close relations to the elementary schools of the State through the high schools, its courses of study are made accessible to the youth of every neighborhood. The complete organization of its several departments promises a high degree of culture to intelligence in every industry and calling. The generous endowment by the general government goes far toward meeting its current expenses. The board ask only for the generous appreciation accorded in the past, and such continued financial aid as seems to be required by the scope of its work, and by its necessary and natural growth.

TREASURER'S REPORT.

FROM DECEMBER 1, 1882 TO AUGUST 1, 1883.

ROBERT A. DAVISON, *Treasurer.*

IN ACCOUNT WITH THE UNIVERSITY OF MINNESOTA.

CURRENT EXPENSES.

1882.		*Dr.*		
Dec.	1.	To balance from last statement	$5,330 85	
	1.	To transferred from Geol. survey account	178 00	
	21.	To cash from state treasurer	6,538 35	
	23.	To cash from state treasurer	5,561 11	
1883.				
Jan.	15.	To cash from Wm. W. Folwell	4 80	
Feb.	14.	To cash from state treasurer	5,723 04	
	27.	To cash from state treasurer	4,500 00	
March	30.	To cash from state treasurer	6,867 37	
May	1.	To cash from state treasurer	5,308 67	
	29.	To cash from state treasurer	5,840 91	
June	30.	To cash from state treasurer	5,752 22	
July	31.	To Prof. Pike's book account charged to this account in error Nov. 30, 1882	109 85	
	31.	To balance brought from students fees account	200 00	
1883.		*Cr.*		
July	31.	By balance brought from chemical laboratory account		$101 19
	31.	By balance brought from college of agriculture account		1,077 61
	31.	By balance brought from exp. farm and campus account		4,259 88
	31.	Balance brought from employes, workmen account		2,740 00
	31.	By balance brought from furniture account		35 00

July	31.	By balance brought from heating account.		1,765 59
	31.	By balance brought from incidental account		3,493 80
	31.	By balance brought from library account		1,274 96
	31.	By balance brought from repairs accounts..		612 77
	31.	By balance brought from salaries for Instruction account		22,786 00
	31.	By experimental farm fund account carried to this account by error Nov. 30, 1882		671 87
	31.	By balance carried to new account		13,096 50
			$51,915 17	$51,915 17

SALARIES FOR INSTRUCTION.

1882.		*Cr.*	Vchr.		
Dec.	13.	By H. M. Waitt, for salary	8		$85 00
	21.	By faculty, pay roll for December	13		3,100 00
1883.					
Jan.	8.	By E. D. Porter, house rent, two months	26		100 00
	16.	By H. M. Waitt, for salary	31		85 00
	19.	By Wm. H. Leib, for instruction	35		54 00
	31.	By faculty, pay roll for January	39		3,100 00
Feb.	1.	By E. C. Bowen, salary for one-half of October	40		50 00
	19.	By H. M. Waitt, for salary	67		85 00
	28.	By faculty, pay roll for February	69		3,100 00
March	13.	By H. M. Waitt, for salary	71		85 00
	14.	By E. D. Porter, house rent, two months	74		100 00
	31.	By faculty, pay roll for March	87		3,000 00
April	13.	By H. M. Waitt, for salary	95		85 00
	19.	By E. D. Porter, house rent	99		50 00
	30.	By faculty, pay roll for April	101		3,000 00
May	7.	By E. D. Porter, house rent	104		50 00
	12.	By H. M. Waitt, for salary	111		85 00
	31.	By faculty, pay roll for May	122		3,000 00
June	1.	By H. M. Waitt, for balance of salary	123		170 00
	5.	By E. D. Porter, house rent	125		50 00
	8.	By W. H. Leib, for instruction	127		102 00
	30.	By faculty, pay roll for June	154		3,000 00
July	7.	By E. D. Porter, house rent	157		50 00
	31.	By E. D. Porter, salary for July	167		200 00
		Dr.			
July	31.	To balance carried to current expense account		22,786 00	
				$22,786 00	$22,786 00

EMPLOYES AND WORKMEN.

1882.	*Cr.*	Vchr.		
Dec. 21.	By cash salaries for December	13		$400 00
1883.				
Jan. 31.	By cash, salaries for January	39		400 00
Feb. 28.	By cash, salaries for February	69		400 00
March 31.	By cash, salaries for March	87		400 00
April 30.	By cash, salaries far April	101		400 00
May 31.	By cash, salaries for May	122		400 00
June 30.	By cash, salaries for June	154		265 00
July 31.	By cash, janitor's salary for July	167		75 00
	Dr.			
July 31.	To balance carried to current expense account		$2,740 00	
			$2,740 00	$2,740 00

COLLEGE OF AGRICULTURE.

1883.	*Cr.*	Vchr.		
March 14.	By cash, E. D. Porter, expense of Farmers' Lecture Course	73		$1,077 61
	Dr.			
July 31.	To balance carried to current expense acoount		$1,077 61	
			$1,077 61	$1,077 61

CHEMICAL LABORATORY.

1882.	*Cr.*	Vchr.		
Dec. 28.	By cash, Jas. W. Queen & Co., merchandise	19		$59 90
1883.				
Feb. 14.	By cash, Geo. Huhn & Co., merchandise	60		20 10
June 14.	By cash, Geo. Huhn & Co., merchandise	140		21 19
	Dr.			
July 31.	To balance carried to current expense account		$101 19	
			$101 19	$101 19

GEOLOGICAL SURVEY.

1882.	*Cr.*	Vchr.		
Dec. 1.	By balance from last statement			$30,565 27
1.	By current expense	1		178 00
22.	N. H. Winchell. sundry expenses	10		85 45
22.	By pay roll, salaries for December	13		300 00

			Vchr.		
1883.					
Jan.	8.	By Jas. A. Dodge, analyzing stones	24		178 00
	31.	By pay roll, salaries for January	39		300 00
Feb.	3.	By C. L. Herrick, salary for January	41		75 00
	5.	By N. H. Winchell, petty bills and expenses	42		50 32
	5.	By N. H. Winchell, sundry bills	43		13 73
	16.	By S. M. Williams, books blank	64		6 10
	28.	By pay roll, salaries for February	69		300 00
March	6.	By H. Mayhew, water for analysis	70		5 80
	31.	By pay roll, salaries for March	87		450 00
April	5.	By Chas. E. Young, printing and letter heads	90		10 00
	30.	By pay roll, salaries for April	101		375 00
	30.	By N. H. Winchell, traveling expenses, etc	102		115 12
May	10.	By Jas. W. Queen & Co., goods for experiments	107		13 75
	26.	By N. H. Winchell, sundry bills	120		3 59
	31.	By pay roll, salaries for May	122		375 00
June	13.	By Wm. Howling, mounting birds	136		15 00
	19.	By H. H. Young, labor	143		30 00
	30.	By pay roll, salaries for June	154		300 00
July	21.	By A. H. Chester	165		100 00
	31.	By pay roll, salaries for July	167		300 00
		Dr.			
	31.	To balance carried to new account		$34,145 13	
				$34,145 13	$34,145 13

INCIDENTALS.

		Cr.	Vchr.	
1882.				
Dec.	8.	By Emily L. Hough, writing, etc	3	$21 00
	8.	By Lane & Davis, labor and mdse	4	30 00
	8.	By Wales & Co., picture frames and glass	5	91 21
	8.	By Wales & Co., picture frames, etc	6	20 10
1883.				
Jan.	3.	By H. J. Cobb & Son, merchandise	22	10 80
	8.	By Bradner-Smith Paper Company, merchandise	23	43 14
	8.	By W. W. Folwell, dinners for board of regents	25	6 00
	16.	By Emily L. Hough, writing, etc	32	24 80
	27.	By W. B. Dunnell, plans for building	36	75 00
	31.	By Berry & Onion, merchandise	38	15 69

1883.			Vchr.	
Feb.	10.	By C. W. Davison, directory	46	3 00
	13.	By B. Brown, carriage	50	6 00
	14.	By Minneapolis Tribune Co., papers	52	8 00
	14.	By E. C. Pratt, expressage	55	5 50
	14.	By W. W. Parker, mounting picture	59	10 00
	15.	By Pioneer Press Co., advertising	62	3 40
	15.	By Berry & Onion, oil, etc	63	10 65
	19.	By W. F. Decker, sundry bills	66	15 20
March	13.	By Ariel Association, ensealing prospectus	72	75 00
	15.	By C. W. Hall, sundry expenses	76	41 85
	16.	By McMillan & Hastings, insurance	79	576 00
	16.	By Bradner-Smith Paper Co., envelopes	80	21 25
	16.	By Berry & Onion, oil	81	5 30
	20.	By Emily L. Hough, clerical services	84	15 60
	20.	By Emily L. Hough, clerical services	85	23 00
	27.	By St. Paul Fire and Marine Insurance Co., insurance	86	279 00
	31.	By American Express Co., express	88	32 85
April	5.	By Berry & Onion, merchandise	89	6 30
	6.	By E. C. Pratt, expressage	91	2 50
	6.	By Evening Journal, advertising	92	10 00
	6.	By Gust. E. Stechert, merchandise	93	6 24
	16.	By Wm. A. Pike, freight, etc	97	58 14
	26.	By Tinius Olson & Co., testing machine	100	500 00
May	1.	By E. E. White, music books	103	5 00
	8.	By Emily L. Hough, clerical services	106	18 60
	11.	By Johnson, Smith & Harrison, printing	109	247 10
	12.	By Emily L. Hough, writing	110	26 60
	12.	By C. D. Whitall & Co., books	113	5 00
	15.	By Emily L. Hough, writing	114	4 85
	12.	By Geo. Kuhn, filing plat of R. add	116	6 93
	17.	By Lockwood, Upton & Co., labor, etc.	118	7 75
	26.	By Tinius, Olsen & Co., balance due on testing machine	121	260 00
June	4.	By H. M. Waitt, sundry bills	124	6 24
	9.	By J. E. Gallow, freight paid	128	28 00
	9.	By J. E. Gallow, freight and cartage	129	15 27
	13.	By Chas. D. Whitall & Co., merchandise	131	16 58
	13.	By Tribune job department, printing	132	45 50
	13.	By F. Engel, binding reports	133	48 50
	13.	By F. Danz, music at commencement	134	60 00
	13.	By Emily L Hough, ribbons	137	3 00
	13.	By Emily L. Hough, writing	138	26 60
	13.	By Berry & Onion, merchandise	139	3 70
	14.	By I. Monasch, diplomas	141	13 50
	19.	By Phelps & Bradstreet, use of chairs	144	7 30
	22.	By Nelson, Tenney & Co., lumber	147	22 99

			Vchr.		
1883.					
June	22.	By Bardwell, Robinson & Co., moulding	148		3 00
	26.	By Stone & Hulbert, insurance	149		90 00
	26.	By W. F. Decker, sundry bills, etc.	150		28 48
	26.	By W. F. Decker, sundry bills	151		30 10
	26.	By W. F. Decker, sundry bills	152		23 31
	30.	By M. W. Glenn, labor and repairs	153		14 55
July	6.	By R. S. Davison & Co., sundry expenses	156		9 35
	9.	By Tribune job department, calendars	158		355 98
	9.	By Ariel Association, advertising	159		7 50
		Dr.			
July	31.	To balance carried to current expense account		$3,493 80	
				$3,493 80	$3,493 80

LIBRARY.

		Cr.	Vchr.		
1882.					
Dec.	21.	By O. M. Laraway, postmaster, books	14		85 47
	28.	By E. and J. B. Young & Co., books.	17		85 54
	28.	By Estes & Lauriat, books	18		162 75
1883.					
Jan.	10.	By O. M. Laraway, postmaster, books	29		95 35
	15.	By O. M. Laraway, postmaster, magazine subscription	30		14 45
	29.	By B. F. Stevens, foreign reviews	37		5 60
Feb.	10.	By O. M. Laraway, postmaster, books	44		19 35
	12.	By Mrs. Allen Whitman, books	47		135 00
	12.	By Jos. R. Osgood & Co., book index	48		16 50
	12.	By W. O. Davis & Co., books	49		119 10
May	10.	By Gust. E. Stechert, books	108		211 66
June	12.	By Charlotte A. Rollit, paid out for labor	130		8 40
	20.	By Gust. E. Stechert, books	145		281 18
	20.	By S. A. Brown, clerk department of state, packing, etc	146		30 00
July	9.	By Gust. E. Stechert, books	160		2 36
	10.	By Johnson, Smith & Harrison, printing	162		2 25
		Dr.			
July	31.	To balance carried to current expense account		$1,274 96	
				$1,274 96	$1,274 96

REPAIRS.

1883.		*Cr.*	Vchr.		
Jan.	17.	By George Gray, paints, varnish, etc.	33		$9 75
	19.	By George Gray, painting	34		140 70
April	14.	By Sykes & Andrews, material and labor	96		314 49
June	18.	By John T. Lucas, repairing roof	142		2 00
July	10.	By Folds & Griffith, carpeting, curtains, etc	161		65 53
	14.	By Lister Bros., labor	163		80 30
		Dr.			
July	31.	To balance carried to current expense account		$612 77	
				$612 77	$612 77

EXPERIMENTAL FARM AND CAMPUS.

1882.		*Cr.*	Vchr.	
Dec.	1.	By Geo. Huhn & Co., mdse	2	$2 48
	11.	By E. D. Porter, labor, pay roll for November	7	382 46
	20.	By Miller Bros., mdse	9	286 78
	28.	By Jas. W. Queen & Co., mdse	15	14 15
	28.	By C. A. Smith & Co., wagon	16	60 00
	30.	By Merriman, Barrows & Co., lumber	20	122 47
	30.	By W. Q. Greeley, blacksmithing	21	37 80
1883.				
Jan.	8.	By E. D. Porter, labor, pay roll for December	27	310 81
	9.	By Wyman Elliot, plants and seeds	28	94 59
Feb.	10.	By Pike & Sturtevant, surveying and staking	45	33 50
	14.	By C. W. Shatto, bob sleds, etc	53	33 60
	14.	By Hobart & Chattendon, posts for fencing	54	43 92
	15.	By Chas. Robinson, abstract of Thatcher's addition	61	5 75
	17.	By Stammwitz & Schober, feed	65	14 87
	19.	By E. D. Porter, labor, pay roll for January	68	150 39
March	14.	By E. D. Porter, labor, pay roll for February	75	153 27
April	11.	By Jno. Leinen, rent of land, seed, etc	94	157 99
	19.	By E. D. Porter, labor, pay roll for March	98	206 40
May	7.	By E. D. Porter, labor, pay roll for April	105	350 41

1883.		Vchr.		
May 12.	By Hull & Dyer, blacksmithing......	112		30 95
17.	By Anthony Kelly & Co., mdse., cement......	117		42 25
June 5.	By E. D. Porter, labor, pay roll for May......	126		818 43
July 5.	By E. D. Porter, labor, pay roll for June......	155		906 61
	Dr.			
July 31.	To balance carried to current expense account......		4,259 88	
			$4,259 88	$4,259 88

ENLARGEMENT OF CAMPUS.

1882.	*Dr.*	Vchr.		
Dec. 1.	To balance from last statement......		$3,127 56	
1883.	*Cr.*			
March 20.	By Geo. M. Hunt, release of tax title	83		$35 00
May 18.	By Wetmore heirs, deed to lot in campus......	119		500 00
11.	By Tribune Printing Co., notices......	115		72 00
July 20.	By J. E. Gallow, deed to lot in campus	164		350 00
30.	By O. D. Thatcher, E. L. P. Thatcher and C. Dexter, deed to lot in campus	166		550 00
31.	By balance carried to new account.....			1,620 56
			$3,127 56	$3,127 56

FURNITURE.

1883.	*Cr.*	Vchr.		
March 17.	By Wm. Glessner & Son, office desk...	82		$35 00
	Dr.			
July 31.	To balance carried to current expense account......		$35 00	
			$35 00	$35 00

HEATING.

1882.	*Cr.*	Vchr.		
Dec. 22.	By Armstrong & Truesdell, fuel......	11		$894 37
22.	By Armstrong & Truesdell, fuel......	12		365 57
1883.				
Feb. 14.	By Ball & Naylor, work on boiler......	51		1 25
14.	By Sykes & Andrews, steam gauge.....	56		4 00
14.	By Sykes & Andrews, labor and mdse	57		33 65
14.	By Sykes & Andrews, stop valve......	58		4 00

		Vchr.		
1882.				
March 16.	By Armstrong & Truesdell, fuel........	77		257 00
16.	By Armstrong & Truesdell, fuel........	78		131 25
June 13.	By Armstrong & Truesdell, fuel........	135		74 50
	Dr.			
July 31.	To balance carried to current expense account....................................		$1,765 59	
			$1,765 59	$1,765 59

STUDENTS FEES.

1882.	*Dr.*		
Dec. 23.	To cash received from W. W. Folwell	$200 00	
1883.	*Cr.*		
July 31.	By balance carried to current expense account..........................		$200 00
		$200 00	$200 00

PROF. PIKE'S BOOK.

1882.	*Cr.*		
Dec. 1.	By balance from last statement..........	$109 85	
1883.	*Dr.*		
June 25.	To Prof. W. A. Pike, from sale of 300 pamphlets		$27 99
July 31.	To balance carried to new account....		81 86
		$109 85	$109 85

SALT LAND SALES.

1882.			
Dec. 1.	To balance from last statement............		$17,501 37
5.	To cash received from H. G. Stordock, deed to Tore Jorgenson of the N. ½, S. W. ¼, and S. W. ½, S. W. ¼, of sections 28:136:44....................	$600 00	
	and sundry interest payments, etc	334 21	
		$934 21	
	less commission on sale..........	15 00	919 21
27.	To cash received from Chas. J. Wright, being interest due on cert. 14..........		11 90
1883.			
Jan. 18.	To cash received from H. G. Stordock in payment of E. ½, S. E. ¼ and S. ½, N. E. ¼ and N. W. ¼, S. E. ¼ sec. 33:136:45	1,000	
	less commission......................	$25	975 00

1883.					
Feb.	9.	To cash received from Chas. J. Wright, balance due on S. W. ¼, N. W. ¼ sec. 24:133:44		170 00	
	14.	To cash received from First National bank, Fergus Falls, being interest payments on sundry certificates		1,238 15	
March	10.	To cash received from H. G. Stordock, being payment on sale of E. ½, S. E. ¼ sec. 23:136:45	128 40		
		less commission on sale.	12 00	116 40	
	13.	To cash received from H. G. Stordock, being payment on sale of N. ½, S. W. ¼ and S. E. ¼, S. W. ¼ sec. 32:136:44	250 43		
		less commission on sale	19 00	231 43	
April	17.	To cash received from H. G. Stordock, being payment on sale of S. ½, N. W ¼ and S. W. ¼, N. E. ¼ sec. 30:136:44	238 20		
		less commission on sale	22 60	215 60	
June	9.	To cash received from First National bank Fergus Falls, as balance due on S. ½, N. W. ¼ and N. ½, S. W. ¼ sec. 13:133:44		764 32	
	28.	To cash received from Theo.Otjen, being interest due on sec. 35 and ½ of sec 34:136:45		228 48	
	30.	To cash received from C. S. Otjen, being interest due on sec. 2 and W. ½ of sec. 12:135:45 and ½ of sec. 34:136:45		322 43	
July	7.	To cash received from H. G. Stordock, being payments of interest on sundry certificates		1,116 13	
	14.	To cash received from H. G. Stordock, being payments of interest on sundry certificates		246 68	
	16.	To cash received from J. J. Hagerman, being balance due on sec. 27:136:45		2,176 00	
	26.	To cash received from H. G. Stordock, being payments on land and sundry interest payments		600 00	
		By balance carried to new account			26,833 10
				$26,833 10	$26,833 10

BUILDING ACCOUNT.

1882.		*Dr.*	
Dec.	1.	To balance from last statement	$5.610 77

1883.	*Cr.*		
July 31.	By balance carried to new account........		$5,610 77
		$5,610 77	$5,610 77

EXPERIMENTAL FARM FUND.

1882.	*Dr.*		
Dec. 1.	To balance from last statement...........	$671 87	
1883.	*Cr.*		
July 81.	By balance carried to new account.........		$671 87
		$671 87	$671 87

LAND SALE FUND.

1882.	*Dr.*		
Dec. 1.	To balance from last statement............	$528 42	
1883.	*Cr.*		
July 31.	By balance carried to new account.........		$528 42
		$528 42	$528 42

WATER SUPPLY.

1882.	*Dr.*		
Dec. 1.	To balance from last statement............	$402 93	
1883.	*Cr.*		
July 31.	By balance carried to new account.........		$402 93
		$402 93	$402 93

SUMMARY OF ACCOUNTS.

1883.			
July 31.	Building account, to balance................	$5,610 77	
31.	Current expense account, to balance......	13,096 50	
31.	Enlargement of campus account, to balance...	1,620 56	
31.	Experimental farm fund account, to balance..	671 87	
31.	Land sale fund account, to balance.......	528 42	
31.	Salt land sales account, to balance.........	26,833 10	
31.	Water supply account, to balance..........	402 93	
31.	Geological survey account, by balance...		$34,145 13
31.	Prof. Pike's book account, by balance...		81 86
	Balance in treasurer's hands...........		14,537 16
		$48,764 15	$48,764 15

TREASURER'S REPORT.

TREASURER DAVISON'S REPORT FOR YEAR ENDING AUG. 1, 1884.

Robert A. Davison, Treasurer, in Account with University of Minnesota.

CURRENT EXPENSES.

1883.		*Dr.*		
Aug.	1.	To balance from last statement..........	$13,096 50	
Sept.	29.	To cash from state treasurer for July, August and September.	9,582 77	
Oct.	8.	To cash from sale of pine edgings, books, etc..................................	53 95	
Nov.	1.	To cash from state treasurer..............	5,799 93	
Dec.	8.	To cash from state treasurer..............	5,707 29	
1884.				
Jan.	4.	To cash from state treasurer..............	6,312 52	
Feb.	2.	To cash from state treasurer..............	5,022 56	
March	7.	To cash from state treasurer..............	5,062 12	
April	5.	To cash from state treasurer..............	4,691 67	
May	1.	To cash from state treasurer..............	5,829 36	
June	2.	To cash from state treasurer...............	6,685 00	
	23.	To cash refunded to W. W. Folwell....	1 32	
July	2.	To cash from state treasurer..............	7,013 61	
	31.	To balance from students' fees account	1,571 00	
1884.		*Cr.*		
July	31.	By balance transferred from apparatus account......................................		$674 57
	31.	By balance transferred from chemical laboratory account......................		529 55
	31.	By balance transferred from college of agriculture account		8,898 54
	31.	By balance transferred from employes account..................		2,480 00
	31.	By balance transferred from furniture account		8 00
	31.	By balance transferred from heating account.....................................		1,254 99

1884.				
July	31.	By balance transferred from incidental account		4,375 59
	31.	By balance transferred from library account		1,355 41
	31.	By balance transferred from repairs account		497 92
	31.	By balance transferred from salaries for instruction account		31,130 84
	31.	By balance transferred from workshop account		303 02
	31.	By balance carried to new account		24,921 17
			$76,429 60	$76,429 60

SALARIES FOR INSTRUCTION.

		Cr.	Vchr.	
1883.				
Aug.	15.	By E. D. Porter, house rent one and one-half months	5	$75 00
	15.	By C. L. Herrick, work in July	6	100 00
	31.	By E. D. Porter, salary for August	11	200 00
Sept.	29.	By faculty pay roll for September	18	2,535 00
Oct.	31.	By faculty pay roll for October	55	2,760 00
Nov.	30.	By faculty pay roll for November	74	2,760 00
Dec.	21.	By faculty pay roll for December	97	2,760 00
	3.	By W. W. Folwell paid Prof. Brooks, instruction in Latin	78	225 00
	3.	By W. W. Folwell paid Prof. Hutchinson, instruction in Latin	78	150 00
	11.	By W. H. Leib, ten vocal lessons	88	60 00
1884.				
Jan.	31.	By faculty pay roll for January	122	2,760 00
Feb.	29.	By faculty pay roll for February	130	2,760 00
March	31.	By faculty pay roll for March	152	2,760 00
April	10.	By Geo. E. MacLean, salary for March	158	175 00
	30.	By J. C. Hutchinson, extra work in Latin	173	150 00
	30.	By faculty pay roll for April	174	2,935 00
May	28.	By faculty pay roll for May	189	3,010 00
June	5.	By Thomas Peebles, half of September, 1883	202	87 50
	14.	By Geo. E. MacLean, balance due for year	206	58 34
	1 to 30.	By faculty pay roll for June	247	2,835 00
	17.	By Jabez Brooks, for balance of salary 1883 and 1884	208	250 00
	17.	By C. W. Hall, for balance of salary, 1883 and 1884	209	150 00
	18.	By C. W. Benton for balance of salary, 1883 and 1884	212	200 00

1884.		Vchr.		
June 19.	By J. C. Hutchinson for balance of salary, 1883 and 1884	213		100 00
20.	By J. F. Downey, for balance of salary, 1883 and 1884	214		100 00
20.	By Jabez Brooks for balance of salary, 1883 and 1884	215		225 00
20.	By Jno. G. Moore for balance of salary, 1883 and 1884	216		200 00
23.	By Emma F. Trussel, salary for September, 1883	237		50 00
30.	By M. L. Sanford, extra instruction for two terms	246		500 00
31.	By E. D. Porter, salary for July, 1884.	269		200 00
31.	To balance carried to curreent expense account		31,130 84	
			$31,130 84	$31,130 84

EMPLOYES AND WORKMEN.

1883.	*Cr.*	Vchr.		
Aug. 31.	By J. E. Gallow, janitor work in August	11		$ 75 00
Sept. 29.	By pay roll for month of September.	18		125 00
Oct. 31.	By pay roll for month of October	55		335 00
Nov. 30.	By pay roll for month of November.	74		235 00
Dec. 31.	By pay roll for month of December	97		285 00
1884.				
Jan. 31.	By pay roll for month of January	122		235 00
Feb. 29.	By pay roll for month of February	130		235 00
March 31.	By pay roll for month of March	158		235 00
April 30.	By pay roll for month of April	174		235 00
May 28.	By pay roll for month of May	189		235 00
June 30.	By pay roll for month of June	247		175 00
July 31.	By pay roll for month of July	269		75 00
31.	To balance carried to current expense account		2,480 00	
			$2,480 00	$2,480 00

GEOLOGICAL SURVEY.

1883.	*Cr.*	Vchr.		
Aug. 1.	By balance from last statement			$34,145 13
31.	By Warren Upham, work in August.	11		100 00
Sept. 29.	By pay roll for month of September	18		375 00
Oct. 27.	By A. Fuess, microscope and lenses	51		127 34
27.	By N. H. Winchell, petty expenses 6-28 to 9-18	52		33 15
27.	By N. H. Winchell, field expenses for June	53		80 45
31.	By pay roll for month of October	55		375 00

1883.			Vchr.		
Nov.	9.	By Lyman Bros., bottles and corks...	60		1 20
	23.	By Mrs. H. A. Wood, fawn skin.......	62		10 00
	28.	By N. H. Winchell, expenses for October..................................	70		29 68
	28.	By O. T. Sweet, cloth for charts........	72		3 25
	30.	By pay roll for month of November..	74		375 00
Dec.	19.	By C. L. Herrick, six types of animal life................................	94		1 50
	21.	By pay roll for month of December...	97		375 00
	29.	By N. H. Winchell, expenses for November....................................	104		23 74
1884.					
Jan.	15.	By C. L. Herrick, salary for August, 1883..	105		75 00
	31.	By pay roll for month of January	122		375 00
Feb.	29.	By pay roll for month of February....	130		375 00
March	7.	By W. Howling, mounting fawn, etc.	132		41 75
	8.	By C. H. Hitchcock, geological map of United States.........	136		42 00
	11.	By Paul & Sinsheimer, case of drawers	142		40 00
	14.	By S. M. Williams, stationery account	146		3 13
	14.	By S. M. Williams, stationery account	147		4 50
	22.	By N. H. Winchell, expenses and bills for January...............................	149		31 35
	31.	By pay roll for month of March........	152		375 00
April	9.	By H. G. Griswold, plats	155		8 40
	10.	By M. W. Connor, repairs on wagon.	156		5 75
	10.	By I. S. Kellogg, plats, 93...............	159		55 80
	10.	By Paul & Sinsheimer, two wall cases.	163		165 00
	30.	By Pay roll for month of April.........	174		375 00
May	16.	By Charles D. Whitall & Co., books..	181		27 55
	17.	By Charles E. Young & Co., label cards	184		3 00
	28.	By pay roll for month of May..........	189		300 00
	29.	By N. H. Winchell, expenses February, March and April	192		46 31
June	13.	By L. Laramie, harness...................	204		25 00
	21.	By N. H. Winchell, expenses for May	218		11 65
	21	By William J. Scott, lynx...............	231		2 00
	21.	By C. W. Hall, expenses on trip.......	235		6 92
	30.	By pay roll for month of June	247		300 00
July	3.	By Empire Distilling Company, barrel alcohol................................	250		28 50
	17.	By H. V. Winchell, work in laboratory	264		65 00
	26.	By N. H. Winchell, expenses in June	266		27 70
	30.	By C. L. Herrick, petty expenses......	268		20 35
	31.	By pay roll for month of July........ .	269		375 00
	31.	To bal. carried to new account.........		39,267 10	
				$39,267 10	$39,267 10

INCIDENTAL ACCOUNT.

1883.		*Cr.*	Vchr.	
Aug.	7.	By Gale & Co., insurance	1	$225 00
	11.	By H. J. Fletcher, transcript of lectures	2	98 00
	22.	By J. C. Arthur, botanical work and expense	8	32 15
	25.	By O. M. Laraway, for postage	9	13 75
	27.	M. L. Sanford, work and expense in summer school	10	64 62
Sept.	1.	By Robert Barker, patching ceiling	12	1 50
	19.	By Barnard & Cope, rent of chairs	13	7 50
	26.	By W. A. Pike, express, telegrams, etc	17	12 40
Oct.	6.	By J. E. Gallow, help in cleaning buildings	24	59 25
	6.	By M. L. Sanford, ribbon for college colors	26	6 50
	6.	By Delta Sigma Soc., use of piano	27	7 00
	6.	By J. H. Locke, use of piano three months	28	7 80
	6.	By W. W. Folwell, petty expenses, freight, express, etc., for year 1881-82	29	146 76
	6.	By W. W. Folwell, petty expenses, freight, express, etc., for year 1882-83	31	145 26
	9.	By John E. Nealin, labor 3½ days	32	4 80
	10.	By Berry & Onion, merchandise	34	14 98
	11.	By Johnson, Smith & Harrison, printing	35	14 50
	11.	By St. Paul Fire and Marine Insurance Company, insurance	36	135 00
	13.	By Tribune Job Dep., printing	41	16 00
	13.	By Wales & Co., framing picture	43	2 70
	15.	By B. Brown, carriage Com. day	44	5 00
Nov.	28.	By Evening Journal, advertising	64	4 00
	28.	By Pioneer Press Co., advertising	65	13 60
Dec.	1.	By Galpin & Emerson, material and labor	75	9 52
	3.	By Chas. D. Whitall & Co., mdse	79	10 37
	3.	By Chas. D. Whitall & Co., mdse	80	60 09
	4.	By Dyer & Howard, tuning piano and music	81	6 09
	5.	By McMillan & Hastings, insurance	83	216 00
	7.	By Berry & Onion, mdse	84	5 50
	7.	By Berry & Onion, mdse	85	11 60

1883.			Vchr.	
Dec.	8.	By Kenyon & Lara, carpet and matting	86	17 60
	10.	By Ariel Association, advertising	87	75 00
	20.	By W. W. Folwell, expenses to Nat. T. Ass'n	96	67 90
	21.	By Frank A. Johnson, clerical work in December	98	10 75
	21.	By J. S. Pillsbury, traveling exp., com. on vacancies	99	159 63
	21.	By Minn. Tribune Co., advertising	101	9 00
	24.	By Johnson, Smith & Harrison, printing	102	26 00
	28.	By F. C. Walker, cleaning carpets	103	3 09
1884.				
Jan.	15.	By Greenleaf Clark, traveling exp., com. on vacancies	107	215 60
	22.	By J. B. Gilfillan, traveling exp., com. on vacancies	111	22 00
	25.	By Chas. D. Whitall & Co., mdse	112	17 30
	25.	By J. E. Gallow, hired help in cleaning	114	14 25
Feb.	4.	By F. C. Berry & Co., mdse	124	3 15
	15.	By Kenyon & Lara, stair pads	128	3 00
March	8.	By Ginn, Heath & Co., books	137	6 72
	11.	By Johnson, Smith & Co., printing	141	46 50
	13.	By Merriman, Barrows & Co., lumber	144	22 03
	13.	By Tribune Job Printing Co., printing	145	12 50
	10.	By Janney, Brooks & Co., mdse	140	13 87
	26.	By M. L. Sanford, express charges, etc.	150	2 25
April	10.	By MacClary & Quigley, work and material	157	18 60
	12.	By J. E. Gallow, help hired to clean wells	160	5 00
	12.	By Church & Graves, lumber	161	4 00
	12.	By Galpin & Emerson, materials and labor	162	33 25
	10.	By Wales & Co., framing pictures	164	8 02
	16.	By Louis Dreka, diplomas	168	31 25
	17.	By W. F. Decker, petty expenses to February 23	171	26 16
May	15.	By Commercial Bank, petty expenses from May 29, 1883, to April 12, 1884	177	15 00
	16.	By Junior Annual, advertising	179	20 00
	17.	By C. M. Palmer, publishing advertising	183	16 50

1884.			Vchr.	
May	24.	By Miller Bros., mdse	185	1 00
	29.	By Johnson, Smith & H., printing	190	65 00
	31.	By F. A. Johnson, office work in May	195	22 50
	31.	By H. M. Waitt, petty expenses for year	196	10 27
June	3.	By Wm. Fenwick, sprinkling street	199	1 50
June	14.	By Mary Bowen, office and library work	205	37 00
	17.	By C. W. Hall, petty bills and expenses	210	6 38
	18.	By Frank A. Johnson, postage	211	55 00
	20.	By J. E. Gallow, petty bills and expenses	217	25 45
	21.	By I. Monasch, filling out diplomas	219	10 50
	21.	By Minneapolis Tribune Co., advertising	222	17 50
	21.	By W. W. Folwell, petty bills and expenses	223	179 57
	21.	By F. A. Johnson, office work in April	224	14 10
	21.	By F. A. Johnson, office work in March	225	14 00
	21.	By F. A. Johnson, office work in February	226	15 75
	21.	By F. A. Johnson, office work in January	227	14 75
	21.	By F. A. Johnson, office work in November	228	11 75
	21.	By F. A. Johnson, office work in October	229	11 50
	21.	By F. A. Johnson, office work in September	230	10 50
	21.	By Mary Bowen, office work	232	6 16
	21.	By J. H. C. Hutchinson, work in library	233	13 20
	21.	By N. M. Baker, dusting books	234	19 00
	23.	By Wheaton, Reynolds & Co., hitching posts	236	18 36
	23.	By Johnson, Smith & H., printing	238	670 00
	23.	By C. M. Palmer, pub., advertising	239	5 50
	24.	By Chas. D. Whiteall & Co., merchandise	240	3 50
	25.	By F. Danz, Jr., music at comm	241	75 00
	26.	By Tribune Printing Co., postal cards	242	18 00
	26.	By W. F. Decker, petty bills and expenses	243	20 44
	27.	By Hobart & Chatterton, cedar posts	244	12 50

1884.			Vchr.		
June	27.	By Bradner-Smith Paper Co., paper..	245		6 55
July	2.	By W. W. Folwell, postage bought...	249		50 00
	3.	By Louis Dreka, three diplomas.......	252		3 75
	5.	By Isaac McNair, insurance.............	255		192 50
	5.	By F. A. Johnson, office work, June and to July 5th........	256		62 40
	9.	By Thompson & Worthington, insurance...	259		175 00
	21.	By D. L. Kiehle, traveling expenses, etc..	265		187 80
	30.	By Lettie M. Crofts, library and office work	267		28 75
	31.	To bal. to current expense amount....		$4,375 59	
				$4,375 59	$4,375 59

COLLEGE OF AGRICULTURE.

1883.		*Cr.*		
Aug.	11.	By E. D. Porter, July pay roll for labor..	4	$763 38
Sept.	25.	By E. D. Porter, August pay roll for labor...	16	845 15
Oct.	2.	By John Leinen, cutting grain.........	19	147 75
	10.	By E. D. Porter, September pay roll for labor..................................	33	468 40
	11.	By Sykes & Andrews, material and labor...	37	89 87
Nov.	7.	By E. D. Porter, October pay roll for labor	57	585 74
	28.	By Dr. Geo. Sermon, doctoring horses	63	26 50
	28.	By Sykes & Andrews, repairing pipes, etc	69	5 25
	28.	By Geo. Huhn & Co., merchandise....	71	21 50
	30.	By Chas. Henry, stove, etc.............	73	20 10
Dec.	1.	By Robinson & Mead, tank and water	77	13 00
	15.	By E. D. Porter, November pay roll for labor..................................	92	481 91
Nov.	8.	By Driscoll & Forsyth, blacksmithing	58	19 00
1884.				
Jan.	18.	By E. D. Porter, December pay roll for labor..................................	108	669 45
Feb.	9.	By E. D. Porter, January pay roll for labor	127	558 07
March	5.	By E. D. Porter, February pay roll for labor..................................	131	578 67
	10.	By Janney, Brooks & Co., merchandise	140	352 50

1884.			Vchr.		
April	9.	By E. D. Porter, March pay roll for labor	153		587 72
	14.	By Janney, Semple & Co., merchandise.,	165		3 53
May	5.	By E. D. Porter, April pay roll for labor	175		794 45
	28.	By E. D. Porter, May pay roll for labor	187		869 90
	28.	By H. Sibley & Co., horse lawn mower	188		144 00
	29.	By Driscoll & Forsyth, cutter, sleds and blacksmithing	193		100 50
July	1.	By John Schulte, harnesses	248		75 70
	7.	By E. D. Porter, June pay roll for labor	258		676 50
	31.	To bal. to current expense amount		$8,898 54	
				$8,898 54	$8,898 54

APPARATUS ACCOUNT.

1883.		*Cr.*	Vchr.		
Oct.	6.	By J. H. Ellis, air pump and appliances	20		$125 00
	16.	By Crocker, Pell & Boardman, testing machines	47		31 72
Dec.	5.	By Wingate Bros., material and labor	82		8 00
	18.	By Ashcroft Manufacturing Co., testing pump, boiler, etc	93		59 05
1884.					
Jan.	14.	By Alfred P. Gage, merchandise	106		92 30
	28.	By C. T. Milligan, cylinders, pumps, etc	118		132 62
March	8.	By Alfred P. Gage, sundry rods, tubes, etc	135		21 38
June	4.	By W. H. Walmsley & Co., microscope, etc	200		162 50
July	3.	By P. Boeringer & Son, surveying instruments	254		42 00
	31.	To balance carried to current expenses account		$674 57	
				$674 57	$674 57

CHEMICAL LABORATORY.

1884.		*Cr.*	Vchr.	
O8t.	15.	By Geo. Huhn & Co., merchandise	45	100 71
	18.	By Richards & Co., merchandise	49	22 09
	27.	By Richards & Co., chemicals	50	235 98

			Vchr.		
1283.					
Nov.	1.	By James A. Dodge, petty expenses for years 1882 and 1883	56		97 61
Dec.	21.	By Geo. Huhn & Co., merchandise	100		18 07
1884.					
March	8.	By Geo. Huhn & Co., merchandise	138		22 37
May	16.	By Geo. Huhn & Co., merchandise	180		18 72
	16.	By Thomas Gardiner, scalpels, etc	182		14 00
July	31.	To balance carried to current expense account		$529 55	
				$529 55	$529 55

EXPERIMENTAL FARM FUND.

		Dr.	Vchr.		
1883.					
Aug.	1.	To balance from last statement		$671 87	
1884.					
April	14.	By J. S. Pillsbury, chairman, to pay part of note of $1,500 and interest given by the State University to B. F. Pillsbury. The balance of the amount being paid out of the account of J. S. Pillsbury, chairman of the ex-committee	166		$671 87
				$671 87	$671 87

FURNITURE ACCOUNT.

		Cr.	Vchr.		
1883.					
Nov.	22.	By Folds & Griffith, rug	61		$8 00
1884.					
July	31.	To balance carried to current expense account		$8 00	
				$8 00	$8 00

HEATING AND LIGHTING.

		Cr.	Vchr.		
1883.					
Oct.	6.	By J. E. Gallow, firing for month of September	21		$60 00
	6.	By J. E. Gallow, firing up to October 16, 1882	22		50 00
	29.	By Armstrong & Truesdell, fuel	54		20 00
Dec.	20.	By Littlefield & Son, pipe and repairs	95		10 95
Oct.	11.	By Sykes & Andrews, material and			

			Vchr.		
1884.					
Jan.	29.	By J. S. Pillsbury, one car wood 9½ cords	117		59 20
March	7.	By Berry & Onion, oil, wicks, etc	134		11 10
April	15.	By First Congregational Church, chandeliers	167		75 00
June	3.	By Berry & Onion, oil	198		1 80
July	10.	By Armstrong & Truesdell, fuel	261		808 74
	31.	To balance carried to current expense account		$1,254 99	
				$1,254 99	$1,254 99

STUDENTS FEES.

		Dr.		
1883.				
Aug.	8.	To paid in by Prof. J. A. Dodge	$41 00	
	27.	To paid in by C. L. Herrick	25 00	
Oct.	8.	To paid in by W. W. Folwell	285 00	
Dec.	1.	To paid in by Jas. A. Dodge	185 00	
1884.				
June	3.	To paid in by Jas. A. Dodge	135 00	
	23.	To paid in by W. W. Folwell	900 00	
July	31.	By balance carried to current expense account		$1,571 00
			$1,571 00	$1,571 00

LIBRARY.

		Cr.	Vchr.	
1883.				
Sept.	24.	By E. & J. B. Young & Co., books	14	$3 77
	24.	By G. E. Stechert, books	15	112 52
Oct.	6.	By Geo. H. Keith, order for books	25	3 92
	6.	By W. W. Folwell, books, etc	30	25 65
Dec.	14.	By Commercial Bank, sundry drafts for books	90	179 35
	14.	By Leon Barritt, "Dore's Raven"	91	10 00
Nov.	28.	By J. F. Travis, binding books	68	7 50
1884.				
Jan.	21.	By Commeraial Bank, drafts for books	109	16 05
	25	By Commercial Bank, drafts for books	113	6 00
	30.	By G. E. Stechert, books	120	338 08
Feb.	27.	By Commercial Bank, drafts for books	129	27 90
March	12.	By Mrs. S. J. Hall, books	143	11 00
	26.	By G. E. Stechert, books	151	148 00
May	15.	By F. A. Johnson, books	178	3 26
June	4.	By Gustav E. Stechert, books	201	302 06
July	3.	By Gustav E. Stechert, books	251	160 95
	3.	By St. Paul Book and Stationery Co., books	253	6 00

		Dr.		
Feb.	16.	To paid by A. T. Ormond for books...	$6 60	
		To balance carried to current expense account..................................	1,355 41	
			$1,362 01	$1,362 01

REPAIRS ACCOUNT.

1883.		*Cr.*	Vchr.		
Oct.	6.	By Robert Barker, plastering..........	23		$19 82
	12.	By Nelson, Tenney & Co., lumber....	38		2 42
	12.	By Galpin & Emerson, labor...........	39		15 80
	13.	By Clough Bros., material...............	42		30 94
	15.	By M. W. Glenn, work on boiler......	46		28 60
Nov.	8.	By J. S. Symmonds, glazing and painting..................................	59		66 62
Dec.	1.	By Merriman, Barrows & Co., lumber	76		78 50
1884.					
Jan.	26.	By B. Knowlton, plastering.............	115		4 95
	31.	By Wales & Co., repairing pictures...	121		17 60
Feb.	4.	By Clough Bros., lumber................	123		17 85
March	7.	By Sykes & Andrews, material and labor.....................................	133		149 90
April	16.	By John T. Lucas, on lead pipes......	170		1 75
May	29.	By Sykes & Andrews, material and labor.....................................	191		25 28
	29.	By John T.Lueus, material and labor	194		4 09
June	21.	By Galpin & Emerson, material and labor.....................................	220		33 80
July	31.	To balance to current expense account		$497 92	
				$497 92	$497 92

WORK SHOP ACCOUNT.

1884.		*Cr.*	Vchr.		
March	10.	By Janney, Brooks & Co., tools........	140		$26 10
	24.	By Robinson & Cary, saws...............	148		128 77
April	14.	By Janney, Semple & Co., tools, etc.	165		148 15
July	31.	To balance carried to current expense account..................................		$303 02	
				$303 02	$303 02

LAND SALES FUND.

1883.		*Dr.*	
Aug.	1.	To balance from last statement.........	$528 42

WATER SUPPLY.

1883.		*Dr.*	
Aug.	1.	To balance from last statement..	$402 93

PROF. PIKE'S BOOK.

1883.		*Cr.*	
Aug.	1.	By balance from last statement	$81 86

BUILDING ACCOUNT.

1883.		*Dr.*	Vchr.		
Aug.	1.	To balance from last statement.........		$5,610 77	
Oct.	13.	To cash from state treasurer		4,000 00	
Dec.	12.	To cash from state treasurer		5,000 00	
1884.					
Jan.	25.	To cash from state treasurer		4,000 00	
Feb.	7.	To cash from state treasurer		5,000 00	
April	16.	To cash from state treasurer		12,000 00	
May	5.	To cash from state treasurer		8,000 00	
Jan.	10.	To cash from state treasurer............		5,000 00	
Credited by payments on "Military Building and Drill Hall," as follows:					
1883.					
Oct.	13.	By S. C. Cutter, payment on contract	40		$4,000 00
Dec.	13.	By S. C. Cutter, payment on contract	89		5,000 00
Nov.	28.	By Evening Journal, advertising for bids..	66		15 00
	28.	By Pioneer Press Co., notices for bids	67		21 20
1884.					
Feb.	8.	By S. C. Cutter, payment on contract	125		5,000 00
	8.	By Rust & Coolidge, part pay for roof	126		3,500 00
April	16.	By S. C. Cutler, payment on contract	169		6,000 00
	17.	By Rust & Coolidge, bal. due on roof trusses..	172		1,200 00
May	9.	By S. C. Cutter, payment on contract..	176		6,000 00
	28.	By Crown Iron Works Co., iron rods and straps..................................	186		123 04
June	3.	By Barnard & Cope, chairs..............	197		5,118 75
	7.	By S. C. Cutter, payment on contract	203		4,000 00
	16.	By M. H. Crittendon, skylights........	207		900 00
	21.	By Minn. Tribune Co., notices for bids	221		36 00
July	5.	By Crown IronWorks Co., iron plates	257		24 44
	10.	By S. C. Cutter, payment on contracts	260		1,000 00
	15.	By L. S. Buffington, part payment for work as architect........................	262		500 00
	15.	By Rust & Coolidge, extra work on building....................................	263		17 72
		By balance to new account			6,154 62
				$48,610 77	$48,610 77

SALT LAND SALES.

		Dr.		
1883.				
Aug.	1.	To balance from old account	$26,833 10	
Nov.	2.	To interest, payment from S. L. Crocker on his cert	50 55	
1884.				
Jan.	10.	To sundry payments of interest through First Nat. Bank, Fergus Falls	581 94	
Feb.	19.	To balance of payment due from Chas. J. Wright	539 70	
May	15.	To payment for 40 acres by Brede Thompson	240 00	
June	7.	To sundry payments of int. through Citizens National Bank, Fergus Falls	325 20	
July	3.	To interest payment from Theo. and C. S. Otjen on their certificates	550 91	
	12.	To sundry payments and interest through H. G. Stordock, of Rothsay, Minn.	597 06	
	31.	By balance to new account.		29,718 46
			$29,718 46	$29,718 46

ENLARGEMENT OF CAMPUS ACCOUNT.

1883.		*Dr.*	Vchr.		
Aug.	1.	To balance of old account		$1,620 56	
		Cr.			
Oct.	16.	By Geo. Huhn, register, recording	48		2 00
1884.					
Jan.	22.	By J. B. Gilfillan, commissioner's fees, abstracts, etc	110		158 22
	26.	By S. H. Baker notes, plats, etc	116		25 00
	29.	By Matt. Walsh, county treas., taxes.	119		91 97
March	8.	By Geo. Huhn, register, recording	139		1 25
April	9.	By J. Guilford, chgs. and exp. as atty.	154		261 27
Feb.	7.	By Chas. Kittelson, state treas., state auditor's voucher, No. 22,826, returned	270		8,000 00
1883.					
Dec.	8.	To warrant No. 22,826 from state auditor		8,000 00	
July	31.	By balance to new account			1,080 85
				$9,620 56	$9,620 56

	count		
31.	By balance from water supply account		
31.	To balance from geological survey account	$39,267	10
31.	To balance from Prof. Pike's book account	81	86
31.	To balance, cash on hand to new account	23,457	49
		$62,806	45

SEVENTEENTH ANNUAL REPORT
(THIRD BIENNIAL REPORT)

OF THE

PRESIDENT

OF THE

UNIVERSITY OF MINNESOTA

TO THE

BOARD OF REGENTS.

1882-'83 AND 1883-'84.

THE UNIVERSITY OF MINNESOTA,
MINNEAPOLIS, MINN., July 1, 1884.

To the Honorable Henry H. Sibley, President of the Board of Regents,

SIR: I have the honor, in accordance with law, herewith to transmit the third biennial report (No. 14 of the series) of the condition and progress of the university for the biennial period covering the university years 1882-83, 1883-84.

I have the honor to be,
Very respectfully,
Your obedient servant,

WILLIAM W. FOLWELL,
President.

REPORT.

To the Honorable Board of Regents:

The changes in, and additions to your board and to the faculty, I have fully exhibited in my report of this date to the state superintendent of public instruction. As they will be likewise, without doubt, embraced in the report of the board to the governor, I do not deem it necessary to repeat them here.

I beg to remind the board of the extraordinary service rendered by the general faculty during the past year in carrying the work of the institution successfully under most discouraging circumstances. If no great advance has been made, it may still be claimed that there has been no step backward, in spite of the circumstances.

Since the last report two large classes have been graduated, and the ranks of the alumni correspondingly swelled. The degrees conferred since last report are:

	1883.	1884.
Bachelors of Arts	8	9
Bachelors of Science	7	9
Bachelors of Literature	7	3
Bachelors of Civil Engineering	2	3
Bachelor of Mechanical Engineering	1	...
Bachelors of Medicine	...	2
Totals	25	26

The names, with residences, of these graduates are given in Appendix "A."

The following table shows the number and kind of degrees which have been conferred by this university:

	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	Total.
B. A.	2	1	3	3	9	5	8	4	10	11	8	9	73
B. S.		1	2	5	3	8	10	9	10	9	7	9	73
B. L.			1		4	1	6	4	7	11	7	3	44
B. C. E.			3	3			2				2	3	13
B. M. E.						1					1		2
B. Arch.					1								1
B. Ag.										1			1
M. A.								1	1				2
M. S.										1			1
B. M.												2	2
Totals	2	2	9	11	17	15	26	18	28	33	25	26	212

The whole number of persons graduated is two hundred and four (204), five persons having received two degrees, those in science and engineering, and three bachelors having been awarded master's degrees, after passing the required examinations. No honorary degrees are conferred by this university.

The whole number of women who have been graduated is fifty-nine (59), viz.: bachelors of arts, 10; of science 18; of literature, 31; all of whom have completed the same courses of study as the gentlemen alumni, and undergone the same tests and examinations. So far as observed, the young women have preserved their health as well as the young men. The records of the registrar's office will show that they have not been inferior in any kind of studies. Their degrees, therefore, are of precisely the same value as those received by the young men.

ATTENDANCE.

A summary statement has already been furnished, to be embodied in the report of the board. For the classification and distribution of students during the two years covered by this report, 1882-83 and 1883-84, see Appendix "B." The only remark of importance to be made upon these tables is the continued diminution in the numbers, especially of the lower classes. The reasons for this were discussed in the last report, to which reference is respectfully made. The increased cost of living in the city of Minneapolis may be mentioned as an additional

ADMISSIONS.

The examinations of the High School Board having been resumed, it was not thought necessary for the faculty to hold any "local examinations" in the summer of 1882. Although 1,039 certificates had been granted in the previous year, but three were presented at the university.

The number of applicants for admission in 1882–83 was much greater than in either of the two previous years, but the results of the examinations were not very encouraging. The record for the year 1882–83 is as follows:

RECORD FOR 1882–83.

	Whole No.	Gentlemen.	Ladies.
Examined	87	46	41
Rejected	24	10	14
Admitted	63	36	27
Passed to regular courses	19	14	5
Passed to special studies	10	6	4
On probation to regular courses	21	12	9
On probation to special courses	13	4	9

The distribution of applicants admitted to the different courses of study is as follows:

	Whole No.	Gentlemen.	Ladies.
To the classical course	6	2	4
To the scientific course	26	24	2
To the modern course	8	0	8
To selected studies	23	10	13
	—	—	—
Total	63	36	27

Five gentlemen and one lady of mature age were admitted to take selected studies without examinations, and fifteen or more young men were admitted to shop work, without taking examinations.

RECORD FOR 1883–84.

	Whole No.	Gentlemen.	Ladies.
Examined	104	61	43
Rejected	17	8	9
Admitted	87	53	34
Passed to regular courses	7	4	3
Passed to special courses	5	3	2
On probation to regular courses	58	38	20
On probation to special studies	17	8	

One lady and one gentleman of mature age were admitted without examinations to pursue selected studies. No examinations were required of students in divisions "C" and "D" of the Artisans' Training School, fifty-six in number.

The number of certificates granted by the high school board in the year ending in 1883, was 2,483. There were presented at the university by applicants, 166 certificates, as follows: arithmetic, 5; elementary algebra, 7; geography, 5; United States history, 7; Latin grammar, 6; natural philosophy, 12; physical geography, 7; elementary astronomy, 12; general history, 10; plane geometry, 14; physiology, 13; Cæsar, 11; elementary chemistry, 12; botany, 4; ancient history, 3; elementary algebra, 7; solid geometry, 5; Cicero, 7; Virgil, 6; Greek grammar, 1.

The different towns were represented as follows:

Anoka, 11; Austin, 8; Faribault, 13; Hastings, 9; Kasson, 8; Lake City, 22; Minneapolis (Academy), 27; Monticello, 12; Red Wing, 23; Rochester, 4; St. Peter, 4; Shakopee, 3; Spring Valley, 1; Stillwater, 1; Zumbrota, 20.

These figures indicate a good ground for hope that, at no distant day, the high schools of the State may form a broad and direct avenue from the common schools to the university. It is not merely important, however, that they be so, but that they be known to be so. The people of the State, and all the youth in particular, need to understand that the regular path to the university is through the public high schools of the State.

INSTRUCTION.

Appendix "C" contains the usual tables exhibiting the work of instruction in the several departments.

Attention is respectfully called to the following items of instruction additional to that indicated in the tables, and accordingly outside of the regular work of the institution:

I. THE EVENING DRAWING SCHOOL.

This school was opened by Professor Pike, in 1880. The course includes twenty-five free lessons in mechanical drawing, varied to suit the wants of different classes of young artisans. The number of attendants in 1882–83 was fifty-one, in 1883–84 forty-six. This school is under the direction of Professor Pike, but the instruction has been chiefly given by Instructors Waitt and Decker. This school has been continued in operation and during the past year has been merged with other work, under your authority, into a department of the college of mechanic arts, called the Artisans' Training School, an account of which appears below.

II. THE COURSE IN SHOP WORK.

For an account of the beginning of this work, reference is respectfully made to the last report. The work has been carried on in an efficient manner and now forms part of the artisans' training school, mentioned above.

III. SUMMER SCHOOL OF SCIENCE AND LETTERS.

Reference is respectfully made to my last report, page 59, for an account of the opening of this school and its work in the years 1881 and 1882. This school was reopened in the summer of 1883, according to the following announcement:

THE UNIVERSITY OF MINNESOTA.

SUMMER SCHOOL FOR TEACHERS, 1883.

The following courses of instruction for teachers and others will be opened **at the University** of Minnesota on July 10th, to continue four weeks.

I. Zoology—Mr. C. L. Herrick.

a. Lectures on animal morphology, or the various forms of structure exhibited **by the prominent** subdivisions of the animal kingdom.

b. Laboratory study of types of animal forms illustrating this structure, **and the physiological** functions and development of the same.

1. **Cells as organic** units— their growth and modification.

2. Distribution of labor in the animal body — organs.

3. Grouping of organs — systems.

4. The animal body as a motor — organs of swimming, creeping, walking, flying.

5. The animal body as a chemical and physical laboratory — organs of nutrition, respiration, circulation.

6. The animal body as a tool of the mind organs of sense and the nervous system.

Illustrations, preparations and specimens will be freely used. The laboratory is equipped with compound microscopes and modern appliances. Some instruction in taxidermy and dissection may be offered.

II. Chemistry — Professor J. A. Dodge.

1. In the forenoon, daily, general chemistry, with experiments performed by those taking this part of the subject, and by Prof. Dodge.

2. In the afternoon, daily, analytical chemistry, qualitative and quantitative.

Either part, or both parts, of the above may be taken.

III. French — Professor C. W. Benton.

The course will be adapted to the needs of those in attendance. For beginners, a small book, Chardenal's First French Course, will be used. For advanced students a special class can be formed, in which the work will be conducted in the French language.

IV. English — Professor M. Marston.

The course will occupy four hours per week, and consist of lectures on the history, philology and grammar of the English language, with illustrative examples and exercises. The design will be to put the student in the way of learning the facts which afford the correct data for explaining the grammatical forms and idioms of the English language.

The equipment for carrying on the work of this summer school will be ample. The laboratories, the museums, the library and the conservatory of the university will be brought into constant use.

The only charge for attendance will be a laboratory fee of $1 per week. The lectures are wholly free, and any one or all of the courses may be attended.

Good board can be obtained in the vicinity of the University for from $4 to $6 per week.

Although the courses are undertaken principally to offer the teachers of Minnesota the advantages of the State University and its equipment, all others who love study well enough to come and work with us will be heartily welcomed, Lectures and laboratory work will begin Tuesday, July 10th, at 9 A. M., and close Saturday, August 4th.

For further information or aid in securing board, address either of the professors named in this circular, at Minneapolis.

MINNEAPOLIS, April 20, 1883.

The sudden death of Prof. Marston deprived the attendants of the expected instruction in English. The place of this was supplied partly by a few lessons in rhetoric by Prof. Sanford, but chiefly by an admirable course in didactics by Prof. William H. Payne, of the University of Michigan, whose services were secured by the intervention of the department of public instruction. The number of attendants was 105, a considerable increase on that of previous years.

IV. THE FARMERS' LECTURE COURSE.

Reference is respectfully made to the report of Professor Porter, for information in regard to this course.

THE EQUIPMENT.

BUILDINGS.

Under the head of this department I have nothing to add to the statements and suggestions of the last report, to which I would respectfully refer.

THE EXPERIMENTAL FARM.

The condition and progress of this department is fully set forth in the report of Professor Porter, herewith transmitted, to which reference is respectfully made.

THE FRUIT FARM.

The report of Superintendent Gideon is herewith transmitted, to whose suggestions the board will doubtless give due attention.

THE GEOLOGICAL SURVEY.

The progress of the geological survey, since the last biennial statement, is shown by the issue of two annual reports, the eleventh and the twelfth, and the completion of the first volume of the final report. The former are for the years 1882 and 1883; and the last covers the entire period from 1872 to 1882, but is confined to the work in the southern and central portions of the State. It is with much satisfaction, and some pride, that the university is thus able to make so substantial a contribution to the literature and the geology of the state. The exact description of the geology and natural resources of each county, and the careful mapping of its natural features, in the method adopted, will ultimately give the state of Minnesota one of the most thorough and satisfactory surveys ever executed by any of the states of the Union. The printing of the report has been very slowly carried on, but this is not the fault of the geologists. It might all have been finished in six months, as expected, when it was placed in the printers' hands; but it has been delayed so that it has now occupied over sixteen months. It is finally printed, but has yet to be bound, which will require a few months' further time. According to the orders of the secretary of state, it will be distributed to the public schools and libraries of the state and to the other states, and the remainder of the edition will be sold for the price of actual cost to the state.

Professor Winchell now designs to engage in active field-work in the remaining more northern portion of the state, preparatory to the completion of the second final volume.

Dr. P. L. Hatch, who has been some years engaged on the ornithology, expects to complete his work and tender his final report in a few months.

Mr. C. L. Herrick, has been appointed to examine the mammals of the state, and to make collections of the same for the museum, and will, in about two years, render a final report on the same.

The survey is in a satisfactory condition, and is progressing as rapidly as the small corps of employes can push it.

THE LIBRARY.

The whole number of volumes added in the year 1882–83 was 840, in the year 1883–84, 897. The titles of these accessions are herewith submitted to be printed for the information of the legislature (See Appendix "D.") I beg to refer to the last report for remarks upon the importance of the increase of the library.

The following donations heve been received and duly acknowledged on behalf of the university:

1882-83.

UNITED STATES GOVERNMENT.

Through TREASURY DEPARTMENT:

- Bayley, National Loans of United States.
- Annual Report of Secretary of Treasury, 1882.
- Finance Report, 1882.
- Synopsis of Decisions, 1882.

Through DEPARTMENT OF INTERIOR:

- Report of Board of Indian Commissioners, 1881.
- Official Register, Vol. ii., 1881.
- Report of Commissioner of Education, 1880.
- Bulletin U. S. Geological and Geographical Survey, Vol. vi, No. 3.
- Report of Eighth Census, 1860. Agriculture, Vol. ii.
- Senate Misc. Documents, Vol. i, Forty-sixth Congress, second session.
- House Exec. Docts., Vol. vii, Forty-sixth Congress, second session.
- Senate Journal, Forty-sixth Congress, third session.
- Exec. Docts., Vols. i and iii, Forty-sixth Congress, third session.
- Reports of Committees, Vols. i and ii, Forty-sixth Congress, third session.
- House Journal, Forty-sixth Congress, third session.
- House Executive Documents, Paris Exposition, 5 vols., Forty-sixth Congress, third session.
- House Executive Documents, Public Lands, 2 vols., Forty-sixth Congress, third session.
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Received gratuitously from publishers, to whom the thanks of the board are due:

Monthlies—War Department Weather Report.
Weeklies— Glencoe Register, Glencoe Enterprise, Staats Tidning, N. Y. Witness, Christian Statesman, Svenska Folkets Tidning, Folkebladet, Skandinavien, Lake City Review, Fargo Republican, Saturday Evening Spectator, Official Gazette of Patent Office, Justice, Present Age.
Dailies— Minneapolis Tribune, Minneapolis Evening Journal.

The most important event in university affairs since the l report is probably the opening of the College of Medicine up a plan novel to our country. There can be little or no dou that if the plan shall be patiently and consistently carried o a great advantage will have been gained for professional edu tion in America. I offer for insertion here the following extra from the special announcement, published by your authori near the close of the past university year.

The work of the college has already been begun. In the pa year ('83-'84) three candidates were examined, two of wh were recommended to you for graduation, and were awar their diplomas of bachelor of medicine (M. B.) at the last co mencement. Their names are Hugo Speier and James Ki Simpson.

HISTORICAL.

The organic law of the State establishing the university, enac by the legislature, February 18, 1868, as amended by the act of 1 authorizes the opening of any desired number of departments colleges, specifying, however, the following:

"A department of elementary instruction;
"A department of science, literature and the arts;
"A college of agriculture;
"A college of mechanic arts;
"A college or department of medicine;
"A college or department of law."

The first four had a provisional organization as early as 1 and have since remained in operation. The limited revenue the institution for many years put it beyond the power of regents to organize other departments.

At the time of the last revision of the by-laws, by the bo of regents, in 1874, the following section was inserted in ch er VI:

"SECTION 1. The organization of the other colleges of the university, to wit, of the college of medicine and the college of law, is hereby referred to the president of the university, who is authorized to report at any subsequent meeting of the board."

The subject of the organization of the college of medicine was frequently discussed by the officer referred to with members of the medical profession, and in particular with Dr. Charles N. Hewitt, professor of public health in the university from the year 1873.

The result was an understanding that Professor Hewitt should draw up a communication to be laid before the board of regents, asking their consideration of a plan which they believed would now be found practicable and useful. This communication, forwarded to the president of the university, was by him submitted in lieu of other report, June 29, 1882.

The record of the proceedings of the board of regents of that date contains the following passage:

PROCEEDINGS OF THE BOARD OF REGENTS.

[Extract.]

ST. PAUL, June 29, 1882.

* * * * * * * *

"A communication from Dr. Charles N. Hewitt, secretary of the state board of health, was read, giving the outline of a plan for the organization of the medical department of the University of Minnesota. By invitation of the board, Dr. Hewitt supplemented this communication by remarks in open board. After a lengthy interchange of views concerning the present necessity of such a department, the following resolution was unanimously adopted:

Resolved, That Dr. Hewitt, of Red Wing, and Dr. Leonard, of Minneapolis, and the president of the university be requested to present to this board a plan of organization so proposed, together with a syllabus of examination for medical students."

A true copy,
Attest: J. B. GILFILLAN,
Recording Secretary.

At a meeting of the board of regents held Jan. 5, 1883, the committee mentioned above submitted the following report, prepared by Dr. Hewitt:

THE UNIVERSITY OF MINNESOTA,
Dec. 28, 1882.

To the Honorable the Board of Regents:

Your committee instructed to present a working plan for the college of medicine of the university, respectfully submit the following report:

We are fully aware of the importance of the work committed to us; its influence on the future of medicine in Minnesota, and its relations to efforts now being made for a higher standard of medical education in other states.

We have left no source of information at home or abroad unsought, but have carefully searched the history of medicine for precedents and aids in our work. We have to submit a working plan for the college of medicine which, not behind any in its demands for scholarly and practical acquirements on the part of candidates for licenses or degrees, shall be fully abreast in methods and means of growth with other departments of science and art in our country.

Had further stimulus than your instructions been necessary, we have found it in the urgent need felt and expressed by educated physicians for just such an organization as you have instructed your committee to provide for.

Never before has there been such unanimity among medical men in demanding that examinations for degrees in medicine be separated entirely from the teaching of its theory and practice. You have undertaken this thoroughly practical and necessary work none too soon. Throughout our country the number of colleges legally empowered to teach medicine and confer degrees upon their own pupils is increasing with reckless rapidity. The competition for students so engendered has reduced the standard of qualification of faculties, students and graduates alike, far below the minimum of the reputable colleges who, following the lead of Harvard, are struggling to maintain reasonable requirements for degrees. But all these schools are hampered with the double and difficult duty of teaching and then sitting in judgment on their own work, and are heavily handicapped, as many of their best men admit, in the struggle with other schools, who by that very combination of functions control so largely the number and education of the multitudes of graduates yearly qualified as doctors of medicine. The recent case of the so-called "Bellevue College" in Boston, neither teaching nor examining, but existing only for fees, sustained, however, by the courts as legally authorized by the legislature of Massachusetts, is the last and one of the lowest developments of the mad effort to drag degrees in medicine so low that their value is hardly that of the certificate of a popular quack. To honest and faithful men, whether professors in colleges or practitioners of medicine, as well as to all men and women who know what medicine as an art ought to be, your action will bring welcome relief. In the plan we submit, the aim has been that while the essentials of qualifications for the degrees in medicine are secured in the by-laws organizing this college, matters of detail not so important are put into the more pliable form of regulations, till such time as experience shall determine their proper form and value. The fundamental principles of the organization your committee have to propose are:

1st. To provide a thoroughly competent and independent faculty, whose duty shall be to examine all candidates for licenses and degrees in medicine of the university, who shall be in no way connected with the preparation of such candidates for such examination, and whose sole aim shall be to maintain a standard of qualification fully equal to the highest, and fully in accord with the needs and demands of the people and the time.

2d. That said faculty shall insist upon a clearly-defined preliminary literary and scientific qualification.

3d. That the professional examinations shall, under rigid but reasonable rules, consist of such written, oral and clinical tests as shall fully develop the fitness of candidates, and that stenographic reports of such oral and clinical examinations be taken and preserved.

4th. That for the degree of doctor of medicine, in addition to all other qualifications, there shall be required the preparation and defense of an original thesis upon a professional topic.

Trusting that their labors may be found acceptable and useful toward the great enterprise in hand, they now respectfally submit this, their report, including the attached drafts of by-laws and regulations.

W. H. LEONARD, President.
CHARLES N. HEWITT, Secretary.
WILLIAM W. FOLWELL.

This report was accepted and ordered spread upon the record of the board. The by-laws and regulations were adopted substantially as reported and as printed in the announcement of

May, 1884. A committee of regents was appointed to nominate professors. Their nominations were confirmed at subsequent meetings, and the faculty filled up as follows:

THE FACULTY OF THE COLLEGE.

WILLIAM W. FOLWELL, LL. D., PRESIDENT.	*Minneapolis.*
CHARLES N. HEWITT, M. D., Professor of Preventive Medicine.	*Red Wing.*
WILLIAM H. LEONARD, M. D., Professor of Obstetrics and Diseases of Women and Children.	*Minneapolis.*
FRANKLIN STAPLES, M. D., Professor of the Practice of Medicine.	*Winona.*
DANIEL W. HAND, M. D., Professor of Surgery.	*St. Paul.*
PERRY H. MILLARD, M. D., Professor of Anatomy and Physiology.	*Stillwater.*
CHARLES E. SMITH, M. D., Professor of Materia Medica and Therapeutics.	*St. Paul.*
GEORGE W. WOOD, M. D., Professor of the Diseases of Nervous System, and of Medical Jurisprudence.	*Faribault.*
CHARLES SIMPSON, M. D., Professor of Pathology.	*Minneapolis.*
JAMES A. DODGE, Ph. D., Professor of Medical Chemistry.	*Minneapolis.*

[It needs at this point to be clearly understood that this college is organized as above expressed as an examining and graduating institution. No instruction whatever is offered or proposed. The idea is to have degrees in medicine granted by a faculty who shall not be sitting in judgment on their own pupils, and shall have no interest in graduating candidates except upon ascertained merit.]

TERMS.

In the college of medicine there are two terms in each year: the September term, beginning with the opening of the university year; the April term, beginning on the third Monday in April.

The entrance and scientific examinations take place in the September term; the professional examinations, in the April term.

ENROLLMENT.

Enrollment regularly takes place at the September term upon completion of the entrance examination, but candidates entitled to be excused from this and the scientific examination may be enrolled at the opening of the April term.

No person not enrolled is admitted to the professional examinations. All enrolled students are expected to report in person or in writing, at the beginning of every April term, until graduation. Candidates not so reporting may be dropped from the rolls.

EXAMINATIONS.

These are

(1) THE ENTRANCE EXAMINATION.
(2) THE SCIENTIFIC EXAMINATION.
(3) THE PROFESSIONAL EXAMINATIONS.

I. THE ENTRANCE EXAMINATION.

The entrance examination takes place at the September term in connection with the general examinations conducted under direction of the general faculty for admission to the university.

The entrance examination embraces the following subjects:

(1) The English language, including writing, spelling, grammar, analysis and composition.

(2) Arithmetic, elementary algebra and plane geometry.

(3) Geography, United States history and the outlines of general history.

(4) Latin grammar and Cæsar's Commentaries (or any one Latin author), or an equivalent knowledge of German, French or one of the Scandinavian languages.

The examination certificates of the state high school board are accepted for any of the above subjects, and the holder is accordingly excused from further examination therein.

After passing the entrance examination, the candidate is entitled to apply for enrollment in the college of medicine.

II. THE SCIENTIFIC EXAMINATION.

The scientific examination follows immediately after enrollment in the September term and embraces the following subjects:

(1) **Physical** geography.
(2) **Natural** philosophy.
(3) **Elementary** botany.
(4) **Chemistry.**

This examination is conducted by a committee of the general faculty, one of whom must be a professor of this college.

The certificates of the state high school board are accepted for any of the above subjects except chemistry, in which greater proficiency is required.

Applicants who bring a final certificate for the scientific course of the collegiate department (end of sophomore year,) are excused from the scientific examination as well as the entrance examination.

Applicants who bring a final certificate for the classical or modern courses of the collegiate department are excused from the entrance examination and the scientific examination, except in chemistry.

Baccalaureates of the colleges of science, literature and the arts, of mechanic arts and of agriculture of this university, and gráduates of any reputable college or university are excused from the entrance and scientifie examinations and receive a credit of one year on professional study.

The entrance and scientific examinations are conducted in writing, according to the rules and methods in use in the collegiate department of the university.

III. THE PROFESSIONAL EXAMINATION.

FIRST:—*Examinations for Bachelor of Medicine.*

These take place only in the April term of each year. They are divided among the following nine departments:

(1) Anatomy and physiology.
(2) Pathology.
(3) Materia Medica and therapeutics.
(4) Medical chemistry.
(5) Preventive medicine, personal and public hygiene.
(6) Practice of medicine.
(7) Surgery.
(8) Obstetrics and diseases of women and children.
(9) Diseases of the nervous system, and medical jurisprudence.

The examinations have for their object to test:

1st. The candidate's familiarity with the literature of the subject;

2d. His clinical and laboratory experience. For this purpose, properly authenticated specimens of his work in any department will be examined, and he may submit certificates and the other evidence thereof;

3d. His skill in the actual use of physical, chemical and other tests in diagnosis and the use of remedies and instruments.

It is understood in all cases, that the candidate is prepared for examination on the text-books advised for each department; for which see list of text and reference books in the special announcement of May, 1884.

In the same announcement are summarized the requirements in each of the nine general departments into which the whole science and art of medicine are divided.

In addition to the examinations above an opportunity will be given for special examinations in diagnosis and treatment of diseases of the eye, ear, skin, nervous system, and in forensic medicine, as departments of general practice.

A special examination is provided for such graduates in medicine as wish to prepare themselves for the functions of health officers in the state. It will include the use of a text-book and collateral reading, and will demand on the part of the candidate a familiarity with the subjects of the examination for preventive medicine, as above noted, and greater actual experience in the control of preventible disease, the processes of water, air and food analysis, and the principles and construction of systems of water supply, sewage disposal, and the administration of sanitary law.

The examinations for the degree of bachelor of medicine are conducted in writing, but may be supplemented, at the discretion of the examiner in any case, by oral interrogation.

As prerequisite to admission to the professional examinations of the first year, each candidate must furnish —

(1) A certificate of attendance upon one full course of lectures upon the subjects of each study of this course in some recognized college of medicine or in a school of medical instruction;

(2) A certificate of dissection of the muscular, nervous and circulatory systems, with the contents of the cavities of the head, throat and abdomen.

STANDING PROGRAM FOR WRITTEN EXAMINATIONS.

FOR DEGREE OF BACHELOR OF MEDICINE.

Hour.	First Year.	Second Year.	Third Year.
	Monday.	Wednesday.	Friday.
9 A. M.	Anatomy and Physiology.	Pathology.	Surgery.
2½ P. M.	Medical Chemistry.	Obstetrics and Diseases of Women and Children.	Practice.
7½ P. M.	Materia Medica and Therapeutics.	Medical Jurisprudence.	Preventive Medicine and Public Health.

Written examinations are in such form as to admit of convenient preservation. The detailed regulations for conducting these examinations are made known at the opening.

Examinees conform to requirements intended to protect them against suspicion or suggestion of having submitted answers not their own productions on the spot.

Any person detected in any dishonesty in his examination is at once stricken from the roll of candidates.

The final examinations for the degree of M. B. begin on Tuesday in the second week of the April term at 9 A. M.

These examinations are oral, and a stenographic report of them is made. They include practical and clinical tests and use of instruments and apparatus, intended to assure the examiners of the candidate's qualifications for the practice of his profession.

2.—*Examinations for the degree of Doctor of Medicine.*

This examination consists in each case essentially of a thesis and its defense, but the faculty will demand in all cases clinical and practical tests and operations, which shall enable the examiners to decide not merely upon the scholastic proficiency of the candidates but upon their actual professional skill.

All theses must be upon subjects approved by the faculty, must be founded on original work and certified as the unaided productions of the candidates. Twenty-five printed copies of each thesis must be furnished to the faculty before reading and defense.

All theses to be defended in the April term must be submitted to the dean of the faculty on or before the second Monday in

March. It is advised that the type-writing machine be used for making the copy. The printed copies required to be made after approval of the theses, shall be on the same sized paper as this pamphlet, and the paper shall be white and of the quality as good as that used by the State of Minnesota. The size of page shall be 22 x 38 ems, pica.

The faculty will make a calendar of theses, and publish the same on the fourth Monday in April term (second Monday of term).

GRADUATION.

Graduation takes place at the annual commencement of the university, near the first of June.

All candidates who pass the entrance, scientific and professional examinations including the appropriate clinical and experimental tests incidental thereto, and give satisfactory evidence of having pursued professional studies as required by the by-laws, being twenty-one years of age or upwards, and of good moral character, are recommended by the faculty of the college to the board of regents to receive the degree of bachelor of medicine (M. B.), which degree duly conferred is the warrant of the university of Minnesota for the practice of medicine and surgery.

All candidates for the first degree must furnish satisfactory evidence that they have severally pursued the study of medicine for four years in the office of and under the personal direction of a physician in active practice, who is a graduate of some college or school of medicine recognized by the board of regents, upon the recommendation of the faculty of this college.

Provided, however, that

(1) One course of lectures with other work incidental thereto in a college of medicine recognized as above shall be reckoned as equivalent to eight months of such study.

(2) One term of six months in a school of medical instruction, organized and conducted in conformity with the by-laws shall be equivalent to one year of such study under a preceptor.

(3) Three courses of lectures with work incidental thereto in colleges of medicine recognized as above shall be equivalent to three years of study under a preceptor. One year at least must in all cases have been passed in a preceptor's office.

(4) Graduates of colleges and universities receive a credit of one year on professional study, in consideration of superior liter-

Any bachelor of medicine of this university who furnishes satisfactory evidence that he has been actively engaged in professional practice for three years after his graduation, and who presents and defends a thesis in the manner prescribed is recommended to receive the degree of doctor of medicine (M. D.).

Whenever the examinations for the bachelor's degree in any case evince great proficiency in the literature, theory and practice of medicine the faculty of the college permit the candidate to present and defend a thesis; this being done to their satisfaction they recommend the candidate to receive at once the full degree of doctor of medicine (M. D.).

Doctors of medicine of other colleges of medicine recognized by the board of regents upon the recommendation of the faculty of this college are recommended to receive the degree of doctor of medicine of this university upon successfully defending a thesis in the manner prescribed.

Any graduate so desiring may receive a statement showing the credit marks obtained by him in his several examinations.

SCHOOLS OF MEDICAL INSTRUCTION.

The general character to be assumed by these schools in order to entitle their pupils to credit for their time spent in them, is fixed by the by-law of the board of regents.

The by-law requires (1) a faculty of at least four professors, doctors of medicine graduated from approved colleges; (2) a public hospital of at least twenty beds under the professional control of the professors; (3) instruction for such periods and in such manner as may be satisfactory to the faculty of this college.

In pursuance of their supervisory power the faculty have established the following regulations regarding the instruction in schools of medical instruction:

(1) There shall be at least one hundred and twenty full days of instruction in each year.

(2) The text-book instruction shall be from the following works, or from others fully equivalent:

Anatomy, Gray.
Physiology, Dalton.
Pathology, Wagner.
Materia Medica and Therapeutics, Wood or Bartholow.
Medical Chemistry, Greene.

Practice, Flint.
Surgery, Agnew.
Obstetrics, Lusk.
Women and Children, Thomas and Smith.
Medical Jurisprudence, Taylor.
Preventive Medicine. Parks.
Nervous System, Hamilton A. McL.

(3) Text-book instruction must be illustrated and supplemented by sufficient oral and clinical exercises and demonstrations. Students should be required to preserve careful notes of clinics attended by them.

OF THE FACULTY OF THE COLLEGE OF MEDICINE AS THE STATE MEDICAL EXAMINING BOARD.

The matter of establishing an examining board to pass upon the qualifications of persons wishing to practice medicine and surgery, for the protection of the people against imposture, had been agitated repeatedly in Minnesota, but no legislation was effected till 1883.

To the Hon. W. L. Hollister, of Austin, Minn., senator for the third district, belongs the credit of drafting and securing the passage of an act constituting the faculty of the college of medicine of the university of Minnesota the State medical examining board. It needs to be borne in mind that the functions of the examining board are additional to and entirely separate from those of the same persons constituting a university faculty. The examining board deal with all persons practicing medicine in the State; the faculty, with those desiring to receive the degrees of the university in medicine and surgery.

The full text of the law will be found in the General Laws of Minnesota for 1883, chapter 125, entitled "An act to regulate the practice of medicine in the State of Minnesota."

In accordance with the law, the faculty was duly organized as a "State board of medical examiners," April 19, 1883. Up to May 10, 1884, five hundred and seventy-nine physicians, being graduates of approved colleges of medicine, have complied with the provisions of law and received the certificate of the board accordingly:

The board has held two public examinations for the benefit of persons not graduates of the medical colleges desiring to practice medicine: one at the capitol in St. Paul, Oct. 11, 1883; the other at the university in Minneapolis, Dec. 27 and 28, 1883. Forty-six persons underwent the examinations, of whom twenty-four were successful, and accordingly received the certificate of the board authorizing them to practice.

The board has issued no licenses to undergraduates not affected by the retroactive clause. It is plainly the intent of the act that we should exercise a discreet supervision over any medical college whose curriculum is sufficiently lax to send forth partially educated men in the profession. It is a duty we owe to the profession, to the alumni of such colleges desiring to practice in Minnesota, and the public alike, to require such persons to pass the board examination before commencing practice in the State.

By an opinion rendered by Attorney General Hahn, the last clause of section twelve exempts all parties of five years' practice previous to March 5, 1883, from the obligatory necessity of complying therewith. The intention of the framers of the act was to exempt the five-year men from the penalties only, but the clause was misworded in drafting or engrossing. The board accordingly deems it inexpedient to issue any more exemption certificates. Where the question of time of practice is raised, the party will be required to furnish affidavit. The reason for this action is that some of the parties obtaining this form of certificate have misinterpreted its import.

THE ARTISAN'S TRAINING SCHOOL.

A DEPARTMENT OF THE COLLEGE OF MECHANIC ARTS.

In order to give definite organization and articulation to a considerable amount and variety of work, which for some years had been carried on by the professor of engineering and his assistants, it was thought best at the beginning of the year to group the evening drawing school and three classes in shop work and drawing and the day work in mathematics and drawing, etc., into a separate department of the college of mechanic arts under the above title. The arrangement proved as was expected, a great convenience in administration.

On account of the great importance of the subject and of industrial education, and to secure due credit to the university as the pioneer institution of this education in our state, I request the insertion of a larger part of a special announcement published by your authority at the beginning of the year 1883–84.

This school is the outgrowth of the experiment made during the last three years in giving instruction in shop work, drawing and mathematics to young men intending to become artisans, and to those already at work in the trades.

METHOD OF INSTRUCTION.

The instruction in shop work is given by means of a series of exercises carefully planned, so as to cover in a systematic manner the usual operations in use in the various trades. This course is designed entirely with a view to giving instruction in the use of tools, and not with the object of constructing any article of commerce. For example, in the course in vise work the work begins with a simple exercise in removing the scale from a piece of cast iron, and afterwards filing it to a true plane surface between two lines marked on the sides. During this exercise the student learns how to hold his file and how to move it without rocking, as well as the method of testing a plane surface with a straight edge. From this exercise he passes to more difficult ones, in each of which he applies what he has previously learned, and is taught something new. The course in vise work includes filing to line, filing to template, free-hand filing, fitting, and chipping straight and curved surfaces in cast iron, wrought iron and steel. A similar series of exercises is worked out in the course in forge work, which includes bending, upsetting, drawing, welding, shaping, punching, tempering in water and oil, and with pine wood test.

The course in wood work also is upon the same plan, and includes exercises in sawing, planing, jointing, chiseling, marking, etc., etc.

Experience has shown that young men taking courses similar to the above become expert in the use of such tools as are covered by the courses in a very short time, and that they are able readily to master the special details of the various trades into which these operations enter.

In drawing, beginners are first given a course covered by a text-book prepared by officers of this school. After finishing this work, and becoming reasonably expert in the use of instruments, the student is given practice in making such finished and working drawings as are best suited to his special case.

In mathematics the instruction covers algebra, solid geometry and trigonometry, taught with special reference to the needs of this class of students, and giving many applications to practical matters. Students may also receive instruction in land surveying during the third term.

EQUIPMENT.

The vise shop is furnished with benches, on which are ten vises, with as many complete sets of the tools used in this course, such as files, squares, calipers, chisels, etc. In the forge-shops are eight fixed and one portable forge. The fixed forges are supplied with blast by a Sturtevant pressure blower, and the smoke carried off by means of a Sturtevant exhaust fan, both of which were presented by Mr. B. F. Sturtevant, of Boston. These fans are run by a small Haskins vertical engine set up in this shop. The pulleys and shafting used here were presented by O. A. Pray, of Minneapolis. There are eight anvils, with as many complete sets of tongs and other tools required in the course. The wood shop has benches and the necessary tools for the course. The drawing room is provided with desks for sixty students, and has a collection of drawings and "blue prints," which is constantly increasing.

OFFICERS.

William W. Folwell, President of the University.
William A. Pike, Professor of Engineering.
John F. Downey, Professor of Mathematics.
Wilbur F. Decker, Instructor in Shop Work and Drawing.
Henry M. Waitt, Instructor in Surveying and Drawing.

ORGANIZATION.

The students of this school are separated into four divisions, viz.: (A) Those who wish to devote themselves wholly to shop-work and industrial drawing as a preparation for entering upon active life. (B) Those desiring to receive instruction in mathematics, as well as in shop-work and drawing. (C) Those whom circumstances prevent from taking either of these courses, and who wish day instruction in drawing. (D) The evening drawing class for working artisans.

COURSES OF INSTRUCTION.

A DIVISION.

I. Term.	*II. Term.*	*III. Term.*
Vise Work.	Forge Work.	Wood Work.
Drawing.	Drawing.	Drawing.

B DIVISION.

I. Term.	*II. Term.*	*III. Term.*
Vise Work.	Forge Work.	Wood Work.
Drawing.	Drawing.	Drawing.
Algebra.	Trigonometry.	Solid Geometry or Surveying.

C DIVISION.

Industrial Drawing, beginning at any time, but to be pursued consecutively.

D DIVISION.

Twenty five evening lessons in Mechanical Drawing, beginning in November.

CONDITIONS OF ADMISSION.

For any division, candidates must be at least fifteen years of age and must pass examinations as follows: A Division—In reading, writing and arithmetic. B Division — In reading, writing, arithmetic, plane geometry and elementary algebra. Members of this division who pass examination in geography and United States history may be allowed to select studies from the Collegiate department under direction of the faculty. C and D Divisions — no examinations required.

All members of this school are required to deposit $5 with the treasurer of the university or his agent, which will be returned to members of divisions A, B, and C when connection with the school ceases, less such charges as may be made for damage to tools or other property, and to members of division D when their connection ceases, if they have been regular in attendance, less such charges for damages as may be made. Divisions A, B and C will come under general regulations as to attendance, etc.

TIMES FOR ENTERING.

Students of the B Division should if possible, enter at the beginning of the year; of the A Division at the beginning of terms, of the C Division preferably at the beginning of terms; and of D Division according to notice.

GENERAL INFORMATION.

Students in this school have access to the library, under the usual rules.

Tools and materials for use in the shops are furnished free. Each student furnishes his own drawing instruments and materials. A list and description of these may be found in Pike and Decker's Mechanical Drawing, pages three to seven.

Students can obtain board in private families in the neighborhood at $4 a week and upwards, and in clubs for $2 a week and upwards.

For any further information apply personally, or by letter, to Prof. Wm. A. Pike, at the university.

CONCLUSION.

Having resigned the executive office in the middle of the year 1882-83 and having since by the desire of the board performed the routine duties, I naturally, long since, ceased to concern myself less about the general interests of the institution and to give my attention chiefly to that department of instruction, political science, to which the board were good enough at the time of accepting my resignation to elect me. I have therefore no occasion to submit further suggestions, but may content myself with referring to the last report, pages seventy-two to seventy-
[illegible] here may be found a number of recommendations which
[illegible] ortance at the time they were made,

APPENDIX "A."

GRADUATIONS.

At the eleventh annual commencement, held May 31, 1883, the following twenty-five degrees were conferred:

COLLEGE OF SCIENCE, LITERATURE AND THE ARTS.

For Bachelor of Arts.

Edward Payson Baldwin	Tower City, D. T.
William Eastman Fay	Cambridge, Mass.
Edson Starr Gaylord	Minneapolis.
David Percy Jones	Minneapolis.
Joseph Henry Locke	St. Cloud.
Helen Louise Pierce	Minneapolis.
Martha Alma Sheldon	Excelsior.
Sumner Lincoln Trussell	Champlin.

For Bachelor of Science.

Robert Mowry Bell	Minneapolis.
Frederic Henry Clarke	Boston, Mass.
Louise Elma Hollister	Marshfield.
Edward Corydon Jones	Minneapolis.
George Nelson Salisbury	Faribault.
Charles Frederic Sidener	Red Wing.
Emma Jane Ware	Browndale.

For Bachelor of Literature.

Samuel Doak Catherwood	Austin.
Annie Harriet Jefferson	Minneapolis.
Kate Louise Kennedy	Minneapolis.
Sarah Pierrepont McNair	Minneapolis.
Anna Calista Marston	Minneapolis.
Janet Nunn	Dodge Centre.

COLLEGE OF MECHANIC ARTS.

For Bachelor of Civil Engineering.

William George Peters	Minneapolis.
THESIS: Minnehaha Bridge.	
Louis Orville Smith	Le Sueur.
THESIS: Minneapolis Water Works.	

For Bachelor of Mechanical Engineering.

John Henry Barr	Mankato.
THESIS: Design for an Automatic Cut-off Steam Engine.	

A certificate in Civil Engineering was granted to

Alexander Martin Holcomb	Minneapolis.
THESIS: Iron Railway Bridge in Minneapolis.	

The graduations, twenty-six in number, at the twelfth annual commencement, held May 29, 1884, were as follows:

COLLEGE OF SCIENCE, LITERATURE AND THE ARTS.

For Bachelor of Arts—9.

Elmer Ellsworth Adams	Morrisville, Vt.
Patrick Joseph Butler	Minneapolis.
Oscar Firkins	Minneapolis.
Joseph Henry Capper Hutchinson	Hastings.
Anthony Johnson	Newburg.
Eli Larson	Bratsburg.
Hannah Robie Sewall	St. Paul.
Susan Winifred Sewall	St. Paul
Zenas Newton Vaughn	Austin.

For Bachelor of Science—9.

Nathan Morton Baker, Jr	St. Peter.
Jeremiah Ignatius Donohue	Pilot Mound.
George Lorenzo Hendrickson	St. Paul.
George Horace Klepper	Albert Lea.
Bessie Laythe	Chatfield.
James Eugene Manchester	Blooming Prairie.
Henry Hastings Sibley Rowell	Minneapolis.
Charles Christian Schmidt	Sleepy Eye.
Emma Zwinggi	St. Peter.

For Bachelor of Literature — 3.

Anna Helen Bonfoy	**Minneapolis.**
Belle Marion Bradford	**Empire.**
Adalyna Kingsbury	**Cassopolis, Mich.**

COLLEGE OF MECHANIC ARTS.

For Bachelor of Civil Engineering — 3.

William Ricketson Hoage	**Rochester.**
George John Loy	**Chaska.**
Irving Webber Matthews	**Luverne.**

COLLEGE OF MEDICINE.

For Bachelor of Medicine — 2.

James Kidd Simpson	**Virden, Manitoba.**
Hugo Speier	**Belle Plaine.**

APPENDIX "B."

ATTENDANCE.

The following tables exhibit the enrollment and classification of the students:

SUMMARY, 1882-83.

COLLEGE OR DEPARTMENT.	CLASS.	Gentlemen.	Ladies.	Total.
Science, Literature and Arts	Senior	13	10	23
	Junior	13	6	19—42
Mechanic Arts	Senior	3	....	3
	Junior	2	....	2
	Specials	20	....	20—25
Agriculture	Specials	10	....	10—10
Collegiate Department	I	21	9	30
	II	16	11	27
	III	35	18	53
	Specials	24	22	46-156
		157	76	233
Deduct, twice counted	....	10	....	10
Totals	....	147	76	223

BY CLASSES ONLY.

Seniors of all departments	26
Juniors of all departments	21
Sophomores—Collegiate Department	30
Freshman—Collegiate Department	27
Sub-Freshman—Collegiate Department	53
Specials of all departments	76
Total (less 10 specials twice counted)	223
Candidates for masters' degrees	9
Attending Summer School of Science and Letters	73
Attending Evening Drawing School	51
Attending Farmers' Lecture Course	281
Grand total	637

The distribution of students in the various departments, classes and courses is shown as follows:

COLLEGE OF SCIENCE, LITERATURE AND THE ARTS.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Senior	Classical	6	2	8
	Scientific	7	2	9
	Modern	....	6	6
Totals		13	10	23
Junior	Classical	6	2	8
	Scientific	6	2	8
	Modern	1	2	3
Totals		13	6	19

COLLEGE OF MECHANIC ARTS.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Senior	Civ. Eng	2	....	2
	Mech. Eng	1	....	1
Totals		3	....	3
Junior	Civ. Eng	2	....	2
Specials	Civ. Eng	7	....	7
	Mech. Eng	2	....	2
	Shop Work	6	....	6
	Drawing	5	....	5
Totals		20	....	20

COLLEGIATE DEPARTMENT.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Sophomore, I	Classical	5	1	6
	Scientific	13	2	15
	Modern	3	6	9
Totals		21	9	30—
Freshman, II	Classical	8	1	9
	Scientific	7	3	10
	Modern	1	7	8
Totals		16	11	27—
Sub-Freshman, III	Classical	4	3	7
	Scientific	29	4	33
	Modern	2	11	13
Totals		35	18	53—
Specials		24	22	46—
Total				156

One hundred and eighty-nine students were enrolled as residents of Minnesota, the following counties being represented:

Anoka, 1; Blue Earth, 5; Carver, 2; Chippewa, 1; Clay, 1; Dakota, 6; Dodge, 2; Faribault, 2; Fillmore, 4; Freeborn, 2; Goodhue, 11; Hennepin East, 41; Hennepin West, 59; Le Sueur, 4; Lincoln, 1; Lyon, 1; Martin, 1; Meeker, 2; Mower, 4; Nicollet, 3; Olmsted, 6; Ramsey, 9; Rice, 3; Rock, 1; Stearns, 4; Steele, 4; Stevens, 1; Wabasha, 4; Wright, 4.

Thirty-four were registered from other states and countries, to wit: Canada, 1; Dakota Territory, 8; Florida, 1; Illinois, 6; Indiana, 1; Iowa, 5; Massachusetts, 3; Michigan, 2; Montana Territory, 2; New York, 2; Ohio, 2; Vermont, 1.

SUMMARY, 1883–84.

College or Department.	Class.		Gentlemen.	Ladies.	Totals.
Science, Literature and Art	Senior		14	7	21
	Junior		7	6	13—34
Mechanic Arts	Senior		3	…………	3
	Junior		4	…………	4
	Special		1	…………	1—8
	Art. Tr. Sch...	A	4	…………	4
		B	4	…………	4
		C	8	…………	8
		D	47	…………	47—63
Medicine	Candidatefor B. M....		2	…………	2—2
Agriculture	Special		1	…………	1—1
Collegiate Department	I		17	10	27
	II		19	10	29
	III		38	21	59
	Specials		36	21	57—17
			205	75	280
Deduct, twice counted			1	…………	1
Totals			204	75	279

BY CLASSES ONLY.

Seniors of all departments	24
Juniors of all departments	17
Sophomores—Collegiate Department	27
Freshmen — Collegiate Department	29
Sub-Freshmen —Collegiate Department	59
Specials of all departments	58
Artisans' Training School	63
Candidates for degree B. M	2
Total	279
Candidates for masters' degrees	10
Attending Summer School of Science	105
Attending Farmers' Lecture Course	1,118

The distribution of students in the various departments, classes and courses, was as follows:

COLLEGE OF SCIENCE, LITERATURE AND ART.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Senior.................................	Classical..........................	7	2	9
	Scientific..........................	7	2	9
	Modern..........................	....	3	3
Total............................	....	14	7	21
Junior..........................	Classical..........................	2	1	3
	Scientific..........................	3	1	4
	Modern..........................	2	4	6
Totals............................	....	7	6	13

COLLEGE OF MECHANIC ARTS.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Senior..	Civ. Eng................	3	....	3
Junior..	Civ. Eng.............	2	....	2
	Mech. Eng..........	1	....	1
	Arch..................	1	....	1
Total..	....	4	....	4
Special	Mech. Eng.	1	....	1
Artisans' Training School................	A........................	4	....	4
	B........................	4	....	4
	C........................	8	....	8
	D........................	47	....	47
Totals..	....	63	....	63

COLLEGE OF MEDICINE.

		Gentlemen.		Total.
Candidates for..................................	B. M.	2	....	2

COLLEGIATE DEPARTMENT.

CLASS.	COURSE.	Gentlemen.	Ladies.	Total.
Sophomore	Classical	6	1	7
	Scientific	9	3	12
	Modern	2	6	8
Totals		17	10	27
Freshman	Classical	8	3	11
	Scientific	8	2	10
	Modern	3	5	8
Totals		19	10	29
Sub-Freshman	Classical	6		6
	Scientific	29	2	31
	Modern	3	19	22
Totals		38	21	59
Specials		36	21	57

Two hundred and forty-five (245) were enrolled as residents o Minnesota, the following counties being represented:

Anoka, 3; Blue Earth, 1; Brown, 1; Carver, 3; Chippewa, 1; Clay, 1; Dakota, 6; Dodge, 6; Faribault, 2; Fillmore, 7; Goodhue, 16; Hennepin East, 62; Hennepin West, 71; Jackson, 1 Le Sueur, 2; Lyon, 5; McLeod, 1; Martin, 2; Meeker, 2; Mower, 6; Nicollet, 4; Olmsted, 6; Ramsey, 7; Rice, 3; Rock, 1; Scott, 2; Stearns, 3; Steele, 3; Stevens, 1; Wabasha, 6; Washington, 3 Winona, 1; Wright, 6.

Thirty-four students were enrolled from other states and countries, as follows:

Canada, 2; Dakota Territory, 4; Florida, 1; Illinois, 3; Indiana, 2; Iowa, 5; Massachusetts, 1; Maine, 4; Michigan, 3; New York, 2; Ohio, 2; Pennsylvania, 1; Vermont, 1; Wisconsin, 3 fourteen states and countries.

APPENDIX "C."

WORK OF THE YEAR 1882-83.

THE YEAR BEGAN SEPTEMBER 5, 1882, AND ENDED MAY 31, 1883.

Subjects.	Text Books.	Instructors.	No. of Exercises.	Class.	No. of Students.	Term.
MATHEMATICS.	PROFESSOR J. F. DOWNEY.					
Higher Algebra	Olney	Downey	28	Freshm'n	26	I.
Analytic Geometry	"	"	53	Junior	10	I.
Higher Algebra	"	Hutchinson	29	Freshm'n	26	I.
Trigonometry	"	Downey	34	Freshm'n	36	II.
Differential Calculus	"	"	54	Junior	9	II.
Higher Algebra, 1	"	Hutchinson	51	Sub Fresh	21	II.
" " 2	"	"	26	"	22	II.
Conic Sections	"	Downey	34	Sophom	23	III.
Integral Calculus	"	"	57	Junior	10	III.
Solid Geometry, 1	Wentworth	Hutchinson	55	Sub Fresh	17	III.
" " 2	"	"	55	"	15	III.
Conic Sections	Olney	"	33	Sophom	8	III.
ASTRONOMY.	PROFESSOR J. F. DOWNEY.					
Descriptive	Loomis	Downey	53	Senior	3	I.
Practical	"	"	54	"	4	II.
"	"	"	50	"	7	III.
CHEMISTRY.	PROFESSOR J. A. DODGE.					
Elementary	Barker's	Dodge	55	SubFresh	27	I.
Applied	Lectures	"	55	Sophom	12	I.
Analytical	Appleton's	Dodge & Noyes.	55	Jun., Sen.	9	I.
Analytical	Appleton's, etc.	" "	55	"	14	II.
Analytical	"	" "	30	Sophom	9	II.
General	Avery's	Dodge	55	Freshm'n	19	III.
Elementary	Barker's	Dodge & Noyes.	55	Freshm'n	13	III.
Analytical	Appleton's	" "	55	Jun., Sen.	9	III.
Analytical	"	" "	22	Sophom	8	III.
PHYSICS.	PROFESSOR WM. A. PIKE, in charge.					
Light and Electricity	Ganot	Decker	57	Sophom	10	I.
Elementary	Peck's, Ganot	"	57	Sophom	9	I.
Sound and Heat	Ganot	"	48	Freshm'n	13	II.
Practical Physics		Pike & Decker	50	Senior	4	III.
BOTANY.	PROFESSOR C. W. HALL.					
Elementary	Gray's	Hall	57	SubFresh.	23	III.
Advanced	Gray's	"	57	Freshm'n	21	III.
"	Lectures	"	57	Fresh Sci.	13	III.
"	Laboratory	"	57	Freshm'n	13	III.
ZOOLOGY.	PROFESSOR C. W. HALL.					
Comparative	Lectures	Hall	55	Junior	11	I.
"	Laboratory	"	50	"	11	I.
Elementary	Lectures and	"	20	Sophom	10	III.
"	Laboratory	Herrick	25	"	10	III.

Subjects.	Text Books.	Instructors.	No of Exercises.	Classs.	No. of Students.	Term
GEOLOGY AND MINERALOGY.	PROFESSOR C. W. HALL.					
Geology, general	Le Conte	Hall	55	Senior	24	I.
Geology, economic	Lectures	“	47	“	10	II.
Mineralogy	Lectures	“	57	Junior	17	II.
“	Laboratory	“	36	“	17	II.
ENGLISH.	PROFESSOR M. MARSTON.					
American Authors, etc	Royce's	Mrs. Wilkin	55	SubFresh.	14	I.
How to Write Clearly	Abbott's Manual	“ “	55	Freshm'n	10	I.
History of the English Language	Lectures	Marston	53	Sophom	9	I.
Reading of Chaucer	Carpenter	“	53	“	9	I.
British Eloquence	Goodrich and Lectures	“	53	Senior	11	I.
Addison, etc	Hudson	Mrs. Wilkin	53	SubFresh.	16	II.
Books and Reading	Lectures	Marston	6	“	55	II.
Milton	Sprague & Lect.	“	53	Freshm'n	9	II.
Anglo-Saxon	Carpenter	“	53	Sophom	14	II.
Macaulay, Scott, etc	Harper Series	Mrs. Wilkin	56	SubFresh.	11	III.
Shakspeare	Rolfe & Abbott	“ “	56	Freshm'n	7	III.
Anglo-Saxon	Carpenter	Marston	50	Sophom	4	III.
English Literature	Lect'res & Ward	“	46	Junior	17	III.
English Criticism	Lectures	“	24	Senior	17	III.
GERMAN.	PROFESSOR J. G. MOORE.					
Goethe's Faust	Hart	Moore	56	Sen & Jun	16	I.
Grammar	Whitney	“	56	“ “	16	I.
Reader	Boisen	“	56	Junior	14	I.
Schiller's Egmont, etc	Buchheim	“	56	Freshm'n	15	I.
Grammar	Comfort	Mrs. Wilkin	56	SubFresh.	18	I.
“	“	“ “	56	“	14	I.
Schiller's Wilhelm Tell, etc	Buchheim	Moore	54	Sen & Jun	10	II.
Grammar	Whitney	“	54	Junior	10	II.
Reader	Boisen	“	54	“	10	II.
German History	Taylor	“	54	Freshm'n	14	II.
Historical Ballads	Wagner	“	54	“	14	II.
Grammar	Whitney	Mrs. Wilkin	54	SubFresh.	14	II.
Reader	Boisen	“ “	54	“	14	II.
Grammar	Whitney	“ “	54	“	13	II.
Reader	Boisen	“ “	54	“	13	II.
Laocoon	Lessing	Moore	58	Sen & Jun	9	III.
Deutsche Lyrik	Buchheim	“	58	“	9	III.
Hermann and Dorothea	Hart	“	58	Junior	9	III.
Minna von Barnhelm	Buchheim	“	58	Freshm'n	17	III.
Grammar	Whitney	Mrs. Wilkin	57	SubFresh.	20	III.
Reader	Boisen	“ “	57	“	20	III.
FRENCH.	PROFESSOR C. W. BENTON.					
Literature; age of Louis XIV	Corneille, etc	Benton	55	Senior	17	I.
Grammar and Reader, §1	Bocher's Otto	“	56	Sophom	14	I.
Grammar and Reader, §2	“ “	“	56	“	13	I.
La Grammaire	Sauveur	“	53	Senior	18	II.
Modern Drama	Feuillet	“	53	“	18	II.
History of France	Fleury	“	53	“	18	II.
Hist. Novel: Cinq Mars	Vigny	“	53	“	18	II.
Art	Taine's	“	53	“	18	II.
Grammar and Reader, § 1	Bocher	“	50	Sophom	14	II.
Grammar and Reader, § 2	“	“	50	“	13	II.
Translations into French	Lectures	“	55	Senior	15	III.
Literature of 18th Century	“	“	55	“	15	III.

Subjects.	Text Books.	Instructors.	No. of Exercises.	Class.	No. of Students.	Term
LATIN.	PROFESSOR J. BROOKS, in charge.					
Horace and Hist. Rom. Lit	Chase & Stuart.	Clark	53	Sophom	13	I.
Essays on the above		"	24	"	12	I.
Livy	Lincoln	"	52	Freshm'n	25	I.
Cicero	Chase & Stuart.	"	106	Sub Fresh	21	I.
Exam. on Entrance and Cond.		Brooks & Clark			47	I.
Plautus, Cicero, Pliny		Clark	52	Junior	9	II.
Livy	Lincoln	"	52	Freshm'n	19	II.
Virgil	Frieze	"	52	Sub Fresh	18	II.
Exam. on Condition		"			12	II.
Tacitus & Cicero		"	51	Sophom	10	III.
Virgil	Frieze.	"	54	Sub Fresh	15	III.
Exam. on Condition		"			24	III.
GREEK.	PROFESSOR J. BROOKS, D. D.					
Homer's Odyssey, etc	Weale Series	Brooks	60	Junior	12	I.
Lectures on Homer		"	3	"	12	I.
Xenophon's Memorabilia	Winans	Hutchinson	54	Freshm'n	9	I.
Grammar and Reader	Brooks	Brooks	61	Sub Fresh	5	I.
Exam. of Cond. Students		Brooks & H			4	I.
Æschylus', Prometheus	Mather	Brooks	43	Sophom	3	II.
Essays on Prometheus		"	9	"	3	II.
Xenophon's Memorabilia	Winans	Hutchinson	47	Freshm'n	8	II.
Gram. and Reader and Anabasis	Brooks	Brooks	53	Sub Fresh	6	II.
Exam. of Cond. Students		"			4	II.
Plato's Apology, Crit. & Phædo	Weale	"	40	Sophom	3	III.
Demosthenes' Orations	Heslop	Hutchinson	51	Freshm'n	5	III.
Xenophon's Anabasis	Brice	Brooks	53	Sub Fresh	5	III.
Exam. of Cond. Students		"			4	III.
MENTAL AND MORAL PHILOSOPHY.	PROFESSOR A. T. ORMOND.					
History of Philosophy	Lectures	Ormond	51	Senior	21	I.
Ethics	"	"	54	"	24	II.
Psychology	"	"	54	Junior	22	II.
Natural Theology	"	"	19	Senior	19	III.
Logic	Jevons and Lect.	"	55	Junior	20	III.
HISTORY.	PROFESSOR A. T. ORMOND in charge.					
Ancient	Schmitz	Ormond	54	Sub Fresh	26	I.
Mediæval	Swinton	"	21	Freshm'n	27	II.
Modern	Swinton & Lect.	"	21	Sophom	20	III.
POLITICAL SCIENCE, ETC.	MR. WM. W. FOLWELL.					
History of Civilization	Guizot	Folwell	37	Junior	26	I.
General Philology	Lectures	"	17	"	26	I.
Civil Government	DeTocquevillle.	"		Senior	23	II.
Constitution U. S	Lectures	"	24	"	23	II.
" Minn	"	"	9	"	23	II.
International Law	"	"	10	Seniors	12	II.
Political Economy	"	"	40	"	24	III.
National Economy	"	"	9	"	24	III.
RHETORIC AND ELOCUTION.	PROFESSOR M. L. SANFORD.					
Orations		Sanford	60	Senior	20	I.
Elocution		"	80	"	20	I.
Orations		"	69	Junior	23	I.
Elocution		"	46	"	23	I.
"		"	71	Sophom	27	I.
Compositions		"	10	Sub Fresh	37	I.
Orations		"	69	Senior	23	II.
Elocution		"	92	"	23	II.

Subjects.	Text Books.	Instructors.	No. of Exercises.	Class.	No. of Students.	Term.
RHETORIC AND ELOCUTION. (*Continued.*)		PROFESSOR M. L. SANFORD.				
Orations		“	75	Junior	25	II.
Elocution		“	50	“	25	II.
Rhetoric	Hepburn	“	60	Sophom	30	II.
Compositions		“	12	Freshm'n	34	II.
Elocution		“	12	Sub Fresh	36	II.
Orations		“	57	Senior	19	III.
Elocution		“	76	“	19	III.
Orations		“	30	Junior	10	III.
Elocution		Sanford	45	Sophom	15	III.
Compositions		“	45	“	15	III.
Elocution		“	12	Freshm'n	42	III.
PUBLIC HEALTH AND HYGIENE.		PROFESSOR C. N. HEWITT, M. D.				
Sanitary Science	Lectures	Hewitt	6	Senior	20	III.
School Hygiene	“	“	6	SubFresh.	60	I.
INDUSTRIAL DRAWING.		PROFESSOR WM. A. PIKE.				
Projections	Pike & Decker	Waitt	60	Freshm'n	24	I.
Geometrical	“ “	Pike & assis'nts	55	SubFresh.	29	II.
Descriptive Geometry	Pike (notes)	“ “	55	Sophom.	12	II.
Miscellaneous	Pike & Decker	“ “	25	Evening	51	II.
Miscellaneous	“ “	Waitt	58	Special	7	III.
AGRICULTURE.		PROFESSOR E. D. PORTER.				
No instruction in 1882–3. Old experimental farm sold and new one purchased.						
CIVIL & MECH. ENGINEERING.		PROFESSOR WM. A. PIKE.				
Curves, Leveling & Earthwork	Lectures	Waitt	50	Jun. C. E.	4	I.
Field Work and Drawing		“	50	“	4	I.
Machinery	Unwin	Pike & Decker	50	Sen. M. E.	1	I.
Drawing		“ “	60	“	1	I.
Arches, Retaining Walls, etc	Lectures	Waitt	55	Sen. C. E.	3	I.
Stereotomy		“	60	“	3	I.
Railroad Work and Drawing	Field Work	“	60	“	4	I.
Shop Work		Decker	55	Special	3	I.
Mechanic's (Statics)	Rankine	Waitt	54	Jun. C. E.	6	II.
Drawing (Descrip. Geometry)	Watson	“	55	“	6	II.
Roofs, Trusses & Motive Power	Lectures	Pike	55	Sen. C. E.	4	II.
Drawing		“	55	“	3	II.
Steam Engine	Goodere	Pike	50	Sen. M. E.	1	II.
Mechanics and Strength Mater'ls	Rankine	Pike	55	Jun. C. E.	5	III.
Topography and Drawing		Waitt	58	“	7	III.
Designs and Specifications		Pike & Waitt	58	Sen. C. E.	3	III.
Designs and Specifications		Pike	58	Sen. M. E	1	III.
Drawing on Designs		Waitt	58	Sen. C. E.	3	III.
Drawing on Designs		Pike	58	Sen. M. E.	1	III.
Surveying		Waitt	22	Freshm'n	15	III.
Strength of Materials			50	S'r C&ME	4	III.
MILITARY SCIENCE.		PROFESSOR E. C. BOWEN, U. S. A.				
Squad and Company Drill	Upton	Bowen	30	3 Lower	85	I.
Officers' Drill	“	“	25	Sophom	20	II.
MUSIC.		PROFESSOR WM. H. LEIB.				
Vocal Lessons	Selections	Leib	20	At Large	50	All.

WORK OF THE YEAR 1883-4.

THE YEAR BEGAN SEPT. 4, 1883, AND ENDED MAY 29, 1884.

Subjects.	Text Books.	Instructors.	No. of Exercises.	Class.	No. of Students.	Term.
MATHEMATICS.	PROFESSOR J. F. DOWNEY.					
General Geometry	Olney	Downey	54	Junior	6	I.
Higher Algebra	"	"	55	Fresh	47	I.
Differential Calculus	Olney	Downey	55	Junior	4	II.
Trigonometry	"	"	31	Fresh	45	II.
Higher Algebra	"	"	54	Sub Fresh	60	II.
Integral Calculus	Olney	Downey	55	Junior	4	III.
Conic Sections	"	"	35	Sophom	25	III.
Solid Geometry, 1 ⅔	Wentworth	Hutchinson	56	Sub Fresh	31	III.
Solid Geometry, 2 ⅔	"	"	56	Sub Fresh	32	III.
ASTRONOMY.	PROFESSOR J. F. DOWNEY.					
Descriptive Astronomy	Newcomb	Downey	54	Senior	10	I.
Practical Astronomy	Loomis	Downey	50	Senior	6	III.
CHEMISTRY.	PROFESSOR J. A. DODGE.					
Elementary	Eliot & Storer	Dodge	55	Sub Fresh	28	I.
Applied	Lectures	"	55	Sophom	7	I.
Analytical	Appleton, etc	Dodge, Sidener	55	Jun & Sen	12	I. II.
Analytical	Appleton, etc	Dodge, Sidener	50	Jun & Sen	17	
Analytical	Appleton, etc	Dodge, Sidener	30	Soph	7	II.
General	Avery	Dodge	55	Freshm	26	III.
Elementary (Continued	Eliot & Storer	"	55	Freshm	25	III.
Analytical	Appleton, etc	Dodge, Sidener	55	Jun & Sen	13	III.
Analytical	Appleton, etc	Dodge, Sidener	22	Soph	6	III.
PHYSICS.	PROFESSOR W. A. PIKE, in charge.					
Mechanics	Peck	Decker	55	Junior	5	I.
Light and Electricity	Ganot	"	55	Sophom	8	I.
General Physics	Gage	"	55	Sophom	11	I.
Sound and Heat	Ganot	"	49	Freshm'n	24	II.
Testing Materials		Pike		Sen C Eng	3	II.
BOTANY.		PROFESSOR C. A. HALL.				
Elementary	Gray's	Hall	56	Subfresh.	24	III.
Elementary	"	"	56	Freshman	26	III.
Advanced	Lectures	"	50	"	28	III.
Advanced	Laboratory	"	62	"	28	III.

Subjects.	Text Books.	Instructors.	No. of Exercises.	Class.	No. of Students.	Term.
ZOOLOGY.		PROFESSOR C. W. HALL.				
Comparative	Lectures	Hall	56	Junior	10	I.
Comparative	Laboratory	"	56	"	10	I.
Elementary	Lectures	Herrick	56	Sophom	5	III.
Elementary	Laboratory	"	56	"	5	III.
GEOLOGY AND MINERALOGY.		PROFESSOR C. W. HALL.				
General	Le Conte	Hall	56	Senior	23	I.
Economic	Lectures	"	44	"	7	II.
Mineralogy, Elementary	"	"	55	Junior	10	II.
Mineralogy, Determinative	Laboratory	"	55	"	10	II.
ENGLISH.	PROFESSOR M. L. SANFORD AND PROF. G. E. MACLEAN in charge.					
British Eloquence	Goodrich	Sanford	55	Senior	9	I.
Chaucer		"	55	Sophom	7	I.
American Authors	Royse's	Mrs. Wilkin	56	Subfresh.	24	I.
Criticism **Burke and Wordsworth**	Abbott's Hudson's	"	55	Freshm'n	10	I.
Anglo-Saxon	Corsen	Sanford	55	Sophom	9	II.
Milton		"	55	Freshm'n	6	II.
Burns, Goldsmith	Hudson's	Mrs. Wilkin	52	Subfresh.	20	II.
Anglo-Saxon	Corsen	McLean	55	Sophom	3	III.
English Literature	Shaw	"	55	Junior	14	III.
English Literature	Bascom & lect's.	"	32	Senior	11	III.
Scott and Macaulay	Harper's	Mrs. Wilkin	56	Subfresh.	15	III.
Shakspeare	Hudson's	"	57	Freshm'n	16	III.
GERMAN.		PROFESSOR J. G. MOORE.				
Goethe's Faust	Hart	Moore	56	Sen.&Jun	13	I.
Grammar and Reader	Whitney	"	56	Junior	13	I.
Schiller's Egmont, etc **Grammar**	Buchheim Whitney	"	56	Freshm'n	18	I.
Grammar, 1st ½	Macmillan	Mrs. Wilkin	56	Subfresh.	30	I.
Grammar, 2d ½	"	"	56	"	21	I.
Schiller's Wallenstein **Lessing's Nathan der Weise**	Schæfer Whitney	Moore	51	Sen.&Jun	13	II.
Grammar and Reader	"	"	51	Junior	11	II.
History and Historical Ballads	Taylor Wagner	"	51	Freshm'n	15	II.
Grammar and Reader	Whitney	Mrs. Wilkin	51	Subfresh.	20	II.
Grammar, 2d ½	"	"	51	"	28	II.
History of German Literature **Deutsche Lyrik**	Lectures Buchheim	Moore	54	Sen.&Jun	14	III.
Goethe's Hermann & Dorothea	Hart	"	55	Freshm	20	III.
Grammar **Reader**	Whitney Boisen	"	55	Subfresh.	27	III.
Grammar and Reader	"	Mrs. Wilkin	56	"	17	III.
FRENCH.		PROFESSOR C. W. BENTON.				
Grammar and Reader	Bocher's Otto	Benton	54	Sophom	29	I.
Classical French Literature **Compositions** **History of France**	Racine, etc La Fontaine Fleury	"	55	Seniors	13	II.
Grammar and Reader, 1st ½	Bocher	"	53	Sophom	15	II.
Grammar. 2d ½	"	"	53	Sophom	11	II.
Philosophy of Art **History of Art in Italy**	Taine "	Benton	54	Senior	11	II.

Subjects.	Text Books.	Instructors.	No. of Exercises.	Class.	No. of Students.	Time.
FRENCH.—*Continued.*	PROF. C. W. BENTON.					
Grammar and Reader	Bocher	Benton	55	Sophom	20	III
Fables	La Fontaine					
Musiciens Celebres	Clement					
Compositions						
The Romantic School	Victor Hugo	“	50	Senior	8	III.
Cinq Mars	Vigny					
Literature of the XIX Century	Lectures					
LATIN.	PROF. J. BROOKS in charge.					
Horace	Chase & Stuart	Hutchinson		Sophom	13	I.
Livy and History	Lincoln	Brooks	57	Freshm	23	I.
Cicero	Chase & Stuart	Hutchinson		Sub Fresh	23	I.
Exam. on Ent. and Condition		Brooks and Hutchinson			117	I.
Plautus	Harrington	Hutchinson	50	Junior	6	II.
Sallust		“	50	Freshm	26	II.
Virgil	Frieze	“	50	Sub Fresh	25	II.
Examination on Condition		Brooks and Hutchinson			46	II.
Tacitus and Plautus	Harrington	Brooks	56	Sophom	8	III.
Virgil	Frieze	Hutchinson	56	Sub Fresh	21	III.
Examination on Condition		“			3	III.
GREEK.	PROF. J. BROOKS, D. D.					
Homer's Iliad, Etc	Boise	Brooks	55	Junior	3	I.
Lectures on Homer		“	3	“	3	I.
Xenophon's Memorabilia	Winans	Hutchinson	55	Freshm	8	I.
Grammar and Reader	Brooks	Brooks	60	Sub Fresh	6	I.
Exam. for Ent. and Condition		Brooks and Hutchinson			20	I.
Æschylus' Prometheus		Brooks	48	Sophom	7	II.
Essays on Prometheus	Mather	“	21	“	7	II.
Xenophon's Memorabilia		Hutchinson	50	Freshm	8	II.
Grammar and Anabasis	Winans	Brooks	53	Sub Fresh	6	II.
Examination on Conditions	Brooks	“			10	II.
Plato's Apologue, Crito, etc	Neale	“	50	Sophom	7	III.
Essays on Plato		“	14	“	7	III.
Demosthenes' Orations	Heslop	Hutchinson	56	Freshm	7	III.
Xenophon's Anabasis	Boise	Brooks	57	Sub Fresh	4	III.
Examination on Conditions		“			2	III.
MENTAL AND MORAL PHILOSOPHY.	MR. T. PEEBLES.					
History of Philosophy	Lectures	Peebles	50	Senior	21	I.
Ethics	Calderwood, ½, Lectures, ½	“	53	Senior	21	II.
Logic	McCosh	“	54	Junior	19	II.
Natural Theology	Lectures	“	18	Senior	10	III.
Psychology	Lectures	“	54	Junior	15	III.
HISTORY.	MR. T. PEEBLES in charge.					
Ancient, sections	Barnes	Peebles	90	Sub Fresh	48	I.
Mediæval	Thalheimer	“	22	Freshm	42	II.
Modern	Lectures	“	22	Sophom	23	II.
POLITICAL SCIENCE, ETC.	MR. WM. W. FOLWELL.					
History of Civilization	Guizot	Folwell	35	Junior	18	I.
General Philology	Lectures	“	20	“	18	I.
Civil Government	De Tocqueville.	“		Senior	17	II.
Constitution of the U. S	Lectures	“	29	“	17	II.
Constitution of Minnesota	“	“	10	“	17	II.
International Law	“	“	10	“	17	II.
Political Economy	“	“	41	“	24	III.
National Economy	“	“	6	“	24	III.

Subjects.	Text Books.	Instructors.	No. of Exercise.	Class.	No. of Students.	Term.
RHETORIC AND ELOCUTION.	PROFESSOR M. L. SANFORD.					
Orations		Sanford	55	Senior	20	I.
Elocution		"	80	"	20	I.
Orations		"	39	"	13	I.
Elocution		"	26	"	13	I.
Elocution		"	60	Sophom	30	I.
Compositions		"	10	Sub Fresh	66	I.
Orations		Sanford	63	Senior	21	II.
Elocution		"	84	"	21	II.
Orations		"	30	Junior	10	II.
Elocution		"	20	"	10	II.
Rhetoric	Hill	"	60	Sophom	24	II.
Compositions		"		"	39	II.
Elocution		"		Sub Fresh	67	II.
Orations		Sanford	92	Senior	23	III.
Elocution		"	92	"	23	III.
Orations		"	60	Junior	20	III.
Elocution		"	60	"	20	III.
Compositions		"	84	Sophom	28	III.
Elocution		"	12	Freshm	32	III.
PUBLIC HEALTH.	PROFESSOR C. N. HEWETT, M. D.					
Sanitary Science	Lectures	Hewitt	6	Senior	21	III.
School Hygiene	"	"	6	Sub Fresh	65	I.
INDUSTRIAL DRAWING.	PROFESSOR W. A. PIKE in charge.					
Draughting	Pike and Decker	Pike, Decker and Waitt	55	Freshm	26	I.
Descriptive Geometry	Pike Prints	Pike, Waitt and Decker	57	Sophom	7	II.
Drawing	Pike and Decker	Pike, Waitt and Decker	51	Sub Fresh	35	II.
Drawing	Pike and Decker	Pike	51	Artisans	12	II.
Drawing		Pike and Waitt	57	"	10	III.
Drawing		" " "	57	Special	3	III.
Drawing	Pike and Decker		49	Artisan, D	47	III.
AGRICULTURE.	PROFESSOR E. D. PORTER.					
No regular instruction this year. One student was directed in his studies.						
CIVIL AND MECHANICAL ENGINEERING AND ARCHITECTURE.	PROFESSOR WM. A. PIKE.					
Elements of Mechanics	Goodive	Pike	53	Jun'r M E	1	I
Curves, Leveling, Etc	Henck	Waitt	54	" C E	5	I
Architecture		Pike		" Arch	1	I
Field Work		Waitt	54	Junior	4	I
Arches and Hydraulics	Cain and Box	Pike	54	Sen. C E	3	I
Stereotomy		Waitt	54	" " "	3	I
Drawing		Pike	47	" " "	3	I
Mechanics	Rankine	Waitt	7	Junior	4	II.
Descriptive Geometry	Watson	"	51	"	5	II.
Roofs, Etc.	Pike Prints	Pike		Senior	3	II.
Drawing		"	54	"	3	II.
Mechanics, Dynamics	Rankine	"	54	Junior	2	II.
Mechanics, Statics	Rankine	Waitt	1	Junior	2	III.
Drawing		Pike	57	"	2	III.
Topography, Etc		Waitt	50	"	2	III.
Designs, Etc		Pike and Waitt	47	Senior	3	III.
Drawing		Pike	47	"	3	III.
Surveying	Lect. & field w	Waitt	20	Fresh	37	III.
SHOP WORK.	PROFESSOR WM. A. PIKE in charge.					
Vise Work		Decker	55	Art. & M E	4	II.
Forge Work		"	25	" " "	7	II.
Wood Work		"	56	" " "	8	III.
MILITARY SCIENCE.	Professorship vacant.					
MUSIC.	MR. WM. H. LEIB.					

APPENDIX "D."

STATE EXPERIMENTAL FRUIT FARM,
EXCELSIOR, MINN., NOV. 1, 1884.

To the President of the State University,

SIR: The law requires that I, as superintendent of State fruit farm, report to you, on or before the first day of November of each year, the progress in fruit culture on said farm.

I am happy to state that this year has been a fruitful year and that the yield oi apples was about seventy bushels, all of which we cut and planted the seed — the object being to grow new hardy varieties adapted to our climate, and especially long-keepers of good quality and hardy in tree, of which we now have a lack — this being the third planting. The trees of the first planting are now two years old, and those deemed worthy will be ready to reset a year from next spring, as we grow them until three years old to cull out the tender and unpromising ones. And yet after the most careful culling, it is not to be expected that the most promising ones will all produce first-class fruit — say one in fifty, as that will about tally with our gain from our own growing of seed; though the chances will be a little better from seed grown in the State orchard, as there are no inferior varieties there to adulterate.

Though but one in ten thousand should prove a success, the State could well afford to foot the bill. I lost more than fifty thousand before I got the Wealthy apple, and all at my own expense. Those, however, were from Eastern and Southern seed; but from our own growing of seed the results have been truly encouraging, some forty varieties worthy of culture in any State, so that the outlook yearly brightens for the horticultural future of Minnesota.

But I am sorry to report that the trees from the second planting of seed were mostly lost, cut off near the ground when they first came up, and no trace left as to what did it, whether worms or animals.

The pear culture with us thus far is a failure. No American or European pear has stood our extreme winters, nor have we been able to devise any process of culture which has helped in this matter. As a last resort we have top-grafted some of the most hardy of the Russian pears on the American mountain ash, that being the stock on which the pear has done best in time past, and has stood when all else failed. But the last winter took off all the trees grafted with other than the Russian pears; we then regrafted with Russian pears, and now await the result of another extreme winter.

Grapes and other small fruits are with us a success where soil, location and proper care are combined I shall not stop to pass judgment as to which of each class is the best. * * * * As to the peach we have grown and fruited it successfully, but the winter protection required makes it a dear luxury.

With respect,

PETER M. GIDEON,
Superintendent of State Fruit Farm.

THE

GEOLOGICAL

AND

NATURAL HISTORY SURVEY

OF

MINNESOTA.

THE TWELFTH ANNUAL REPORT,

FOR THE YEAR 1883.

N. H. WINCHELL, STATE GEOLOGIST.

MINNEAPOLIS:
JOHNSON, SMITH & HARRISON,
STATE PRINTERS.
1884.

ADDRESS.

THE UNIVERSITY OF MINNESOTA,
MINNEAPOLIS, MINN., DECEMBER 1, 1883.

To the President of the University :

DEAR SIR :—I herewith tender the twelfth annual report on the progress of the geological and natural history survey of the state. I include herewith a copy of the first annual report for reprint, that report being in constant demand, and out of print now for several years.

Very respectfully, your obedient servant.

N. H. WINCHELL,
State geologist and curator of the general museum.

UNIVERSITY OF MINNESOTA.

HENRY H. SIBLEY, President,	St. Paul.
THOMAS S. BUCKHAM,	Faribault.
GREENLEAF CLARK,	St. Paul.
JOHN S. PILLSBURY,	Minneapolis.
KNUTE NELSON,	Alexandria.
CUSHMAN K. DAVIS,	St. Paul.
JOHN B. GILFILLAN, Secretary,	Minneapolis.

EX-OFFICIO.

LUCIUS F. HUBBARD, *Governor*,	Red Wing.
D. L. KIEHLE, *Superintendent of public instruction*,	Minneapolis.
WM. W. FOLWELL, *President of the University*, Corresponding Secretary,	Minneapolis.

REPORT.

I.

SUMMARY STATEMENT.

The greater portion of the time during the year has been given both by Mr. Upham and myself to the final revision of manuscript for the printers, and the reading of proofs, the preparation of maps, plates and other illustrations, and the proofs of the same, intended for the final report. At the present time the following county maps have been drawn, lithographed and printed, showing the geology and surface features, and the lines of equal elevation above the sea, viz: Houston, Winona, Fillmore, Olmsted, Mower, Dodge, Freeborn, Waseca, Steele, Blue Earth, Faribault, Watonwan, Martin, Cottonwood, Jackson, Murray, Nobles, Pipestone, Rock, Lincoln, Lyon, Yellow Medicine, Redwood, Brown, Nicollet, Le Sueur, Wabasha, Scott, Carver, Wright, Lac qui Parle and Big Stone. The counties of Goodhue, Rice and Dakota, and several others, are in course of preparation, and sufficient examination has been made in nearly all the state as far north as Brainerd, for mapping and reporting in the same manner. In the northern half of the state, also, much information has been obtained. Considerable more work, however, must be done in that portion north of the parallel of Brainerd, where the difficulties of travel increase, and at the same time the geology becomes more difficult and more interesting. Should the survey continue according to the present design, These are all enumerated in the accompanying list of accessions. Exchanges have been made with A. S. Tiffany, of Davenport, Iowa, and John Eyerman, of Carbondale, Pennsylvania.

The final paper of Mr. Herrick on a portion of the *Crustacea* of Minnesota is presented in this report, illustrated by a number of

The intent of the circular issued in 1876[*] respecting the botany of the state has been kept in mind. Several correspondents have contributed both information for a catalogue of the species of the state, and specimens for the University herbarium. During the past two years Mr. Upham has been engaged, casually, in the preparation of such a catalogue. There has been considerable request for a more complete listing, and a more full account of the distribution of the plants of the state, than that of Dr. I. A. Lapham, published by the Minnesota Horticultural Society in 1875. The very complete catalogue, prepared by Mr. Upham, is herewith transmitted as a part of this report. It includes and classifies all reliable information on the botany of the state that is now in the possession of the survey, and will serve as a more useful guide to students and others in the future study of species and their distribution in Minnesota, than anything hitherto published.

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[*] See the fifth annual report, p. 64.

In the registration of specimens lying in the university building in 1873, a lot of miscellaneous rocks, minerals and fossils was found that had been presented by the late Dr. Stoneman, of Minneapolis. The fossils and rocks were evidently from the Trenton at Minneapolis; but as there were no certain records respecting them, they were all entered in the register, and finally published, with the note "records doubtful." (*Fifth annual report*, p. 207.) A slab of fossiliferous limestone (Mus. reg. number 90) was thus referred to the Trenton. In the sixth annual report a fossil trilobite, contained on this limestone, was reported after a casual examination as Asaphus extans, of Hall (*loc. cit.* p. 161), with the remark that it "has a tuberculated surface instead of lamellose."

In March, 1879, at the request of Lieut. A. W. Vogdes this specimen was sent to him, and he kindly returned the specimen with the following description, as a new species, naming it in honor of Dr. Stoneman.

Bathyurus Stonemanii, Vogdes.

Description.—The pygidium is semi-elliptical, strongly convex, and the width a little greater than the length. The anterior margins are rounded, and the outer margins bordered by a well-defined convex limb. The axis is greatly elevated above the sides, and tapers toward the posterior margin, terminating on the limb. The axis is marked with six rings, the first three being well-defined, and the others not so prominently marked. The dorsal furrows are deep and well-defined. The lateral lobes are convex and have five pleuræ, each being separated by deep furrows. The pleuræ are bent downward and backward, and arise from the second, third, fourth and fifth axial rings. They all terminate upon the inside furrow which outlines the limb. The points of termination of the anterior pleuræ are on a line with the fifth axial ring. The entire pygidium is bordered by a convex limb which runs from the fulcral points around it. This limb has an inside furrow which runs between the termination of the axis and the limb, and also an exterior furrow.

The surface of the upper dorsal shell is tuberculated.

Locality and geological position. The Trenton group, probably at Minneapolis, Minn. Presented to the general museum by Dr. Stoneman.

This species approaches B. senectus, Billings, which has six axial rings and four pleuræ. Our species is, however, much larger, and has a greater member of pleuræ. The inside marginal furrow in the former species does not extend all around the pygidium, but ends abruptly at the end of the axis. Billings' species comes from the Potsdam group, and ours from a different geological position. Our species has certain affinities with B. extans, Hall. The most prominent points of difference between the former and that described by Prof. Hall is that the axis is more elevated, and does not terminate so abruptly behind in B. Stonemanii. The second dorsal surface of B. extans is marked with fine imbricating lamellose striæ, whereas our species is tuberculated.

There are three species of this genus described, which appear in the Trenton group; viz. B. extans, H.; B. longispinus, Walcott; and B. spiniger, H. Of all the species, with the exception of the last named, the pygidium is known, and differs from our species. The only part of B. spiniger, H. known to us is the glabella, which is tuberculated; and there is reason to suppose that our species may be the missing part of B. spiniger; but it is doubtful.

The geological range of the genus is from the Potsdam to the Trenton group.

(b)

THE AGE OF THE SANDROCK AT AUSTIN, MOWER COUNTY.

On page 360, of the first volume of the final report of the survey, the age of the sandrock at Austin is considered, and Prof. H. S. Williams is referred to as authority for identification of some fossils from that rock. In justice to Prof. Williams the full text of his communication relating to these fragmentary fossils is herewith given. If the horizon of the Austin rock be in the Marcellus shale, the overlying limestones appearing in the Cedar valley near the state boundary, and further south, probably all fall into the Hamilton epoch.

6. A minute terebratuloid shell of Rensselæria type.

7. Trace of a crinoid stem.

8. Trace of a minute Orthoceras, or (?) Coleolus.

You ask my opinion of the horizon. The material is very unsatisfactory for basing a judgment on: but if the two lots are from the same horizon, it is safe to say that it is lower Devonian.

Taking the fauna of No. 2698 alone, I see nothing to prevent its being Upper Silurian.

If the two lots are from the same rock, I should think from study of the fossils that the horizon is not higher than the base of the Hamilton period, nor lower than the Lower Helderberg; and my opinion is that the fauna belongs to an horizon near the base of the Hamilton, either below it or in an equivalent position to the New York Marcellus. The only really satisfactory fossil is the Productella truncata: and if the brachiopods of No. 2698 came from a stratum under that containing No. 2699, the No. 2698 lot might occur anywhere from the Hamilton down to the Lower Helderberg.

Nucleospira, Rensselæria type of terebratuloids, Cyrtinas and Atrypas are genera passing from Upper Silurian through lower and middle Devonian, and generally do not mark any narrow geological horizon.

From their association, and the fact that they are all minute specimens, I should conclude that it was a sparse fauna in unfavorable conditions of life, which might have lived anywhere along the Upper Silurian or lower Devonian. But the Productellas are peculiar to Devonian and above.

Have you not found any more fossils? I should think a careful search might bring out specimens that could be determined accurately; and it would be interesting to have the means of determining the species.

I wish I could speak more definitely; but this is the best I can do with the specimens. Possibly this with the stratigraphical study may enable you to fix the horizon.

With sincere regard,

HENRY S. WILLIAMS.

(c)

CRETACEOUS LEAVES. PRELIMINARY STATEMENT OF DR. LEO LESQUEREUX.

The Cretaceous leaves that have been obtained in the state from the Cretaceous strata at various times and places, have been submitted to Mr. Lesquereux for determination and description. His final report will appear subsequently, but the following is the result of a preliminary examination of a lot of specimens sent.

Dr. Lesquereux' preliminary report.

The content of the lot, received Jan. 14th, 1884, is as follows:

No. 2143.	From the north side of the Minnesota river, eight miles below New Ulm, represents 4 small undeterminable fragments of leaves, without trace of nervation. No. 2143 (A) is apparently a *Proteoides*.
No. 3808 and 5163.	*Ficus*, sp. nov. No. 5163 is not marked in the list; it is labelled *Austin*.
No. 3911.	*Laurus Nebrascensis*, Lesq., 1 leaf on three pieces.

No. 5155 (C).	*Populus elegans*, Lesq.
No. 5155 (D).	" *Lancastriensis*, Lesq., (probably equivalent to P. cordifolia, Newby).
No. 5155 (F).	*Protophyllum crednerioides*, Lesq.?, a fragment; base of leaf destroyed.
No. 5155 (G, K).	*Populites cyclophyllus*, Lesq.
No. 5155 (I).	2 fragments of superposed leaves, the lower only distinct, *Cinnamomum Scheuchzeri*, Heer.
No. 5155 (L, M, O).	*Populus litigiosa*, Heer, 3 specimens.
No. 5155 (P).	*Populus cyclophylla*, Lesq, a deformed plicate leaf.
No. 5155 (Q & S)	2 fragments of the same leaf, *Platanus primæva*, Lesq., with a leaf of *Persea*?, not yet satisfactorily determined, upon 5155 (S).
No. 5155 (E, N, R).	3 undeterminable fragments.
No. 5156.	*Cissus*, sp. nova; name not yet fixed.
No. 5157 (C).	*Salix proteæfolia*, Lesq., with a branch of Platanus on the reverse.
No. 5157 (A).	*Andromeda Parlatorii*, Heer.
No. 5158.	*Laurus*, sp. nov., not yet named.
No. 5159.	Fragment of undeterminable leaf, areolated by maceration, *Ficus*??.
No. 5160.	Leaf of *Pinus*, sp. nov., not yet named.
No. 5161.	No vegetable remains, but shell or some animal organism. The osseous plate marked by striæ is 2 mm. thick. I have seen along the banks of the Cottonwood river, above the Cretaceous sandstone bearing leaves, large fragments of shells as thick as the plate upon 5161.
No. 115.	*Sequoia*, sp. nov., a specimen which I have already seen here. It bears the label Austin, Minn.

As far as I can see now, the specimens remarked above, 36 in number, represent 16 species, of which 4 are new ones. Of the species, 10 have been recognized in the Dakota group of Kansas and Nebraska, and two in the same Cretaceous formation of Colorado.

The specimens No. 5155 A, down to the end of the list except No. 115, are all from the Cottonwood river, about 3 miles south of New Ulm. They have one species in common with those of the north side of the same river in Brown county, where-from 3 specimens only are sent.

The whole lot is valuable and interesting. One quarto plate would suffice for the figures of the more interesting species and best specimens.

L. LESQUEREUX.

Columbus, O., Jan. 17th, 1884.

III.

THE COMPARATIVE STRENGTH OF MINNESOTA AND NEW ENGLAND GRANITES.[1]

By N. H. WINCHELL.

Having had occasion recently to investigate the qualities of some of the building-stones of the state of Minnesota, I found it necessary to subject them to the usual test of *crushing*, in the form of two-inch cubes, to learn their strength under pressure.

Samples were obtained and dressed to the required size by Mr. William Keating, at the marble shops of Messrs. Sullivan and Farnham, in this city. About one hundred of such cubes were formed, embracing sandstones, limestones, granites and trap rocks. It is intended in this paper to show the remarkable, and unexpected strength exhibited by the crystalline rocks of the state, and especially their superiority in that respect over the granites of New England.

The samples as prepared were carefully chosen to avoid flaws and imperfections due to weathering. They were dressed by hand with hammer and chisel on all six sides, so as to measure two inches on all their edges, the sides all being exact squares. They were sent to Gen. Gillmore, at Fort Wadsworth, Staten Island, where they were subjected to the test for crushing-strength in the same manner as many other granites that have been tested and reported by him in his reports to the chief of engineers, from other portions of the United States and particularly from New England. The tests were applied by Mr. James Cocroft, under the direction of Gen. Q. A.

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[1] Read at the Minneapolis meeting of the American Association for the Advancement of Science. August, 1883.

Gillmore. The samples were crushed between steel plates, one of each stone in the direction of the schistose structure, and another in the direction across it, the former being designated as *on edge* and the latter as *on bed*, with the following results:—

Kind of stone.	Location of quarry.	Position.	Strength in pounds of sample.	Strength in pounds per square inch.
Dark trap rock, massive melaphyr.	Taylor's Falls. Chisago Co.	On bed	105,000	26,250
		On edge	105,000	26,250
Dark trap rock, from a dyke.	Tischer's creek. Near Duluth, St. Louis Co.	On bed	105,000	26,250
		On edge	105,000	26,250
Gray gabbro, massive, fine.	Rice's Point. Duluth, St. Louis Co.	On bed	109,000	27,250
		On edge	105,000	26,250
Red, fine syenite.	Beaver Bay. Lake Co.	On bed	106,000	26,500
		On edge	103,000	25,750
Red, quartzose syenite.	Watab. Benton Co.	On bed	103,000 est.	25,750 est.
		....	103,000	25,750
Red, quartzose syenite.	East St. Cloud. Sherburne Co.	On bed	112,000	28,000
		On edge	105,000	26,250
Red quartzyte.	Pipestone City. Pipestone Co.	On bed	111,000	27,750
		On edge	108,000	27,000
Massive, gray syenite, quartzose.	East St. Cloud. Sherburne Co.	On bed	105,000	26,250
		On edge	103,000	25,750
Fine-grained gray syenite.	East St. Cloud. Sherburne Co.	On bed	112,000	28,000
		On edge	105,000	26,250
Fine-grained gray syenite.	(Probably imperfect sample). Sauk Rapids.	On bed	86,000	21,500
		On edge	100,000	25,200
	Average of 20 samples.......................		104,800	26,200

In order to make a fair comparison, the resultant average strength of the Minnesota samples, crushed between steel plates, should be referred to wooden cushions. Gen. Gillmore's experiments indicate that granite has a greater crushing strength between steel plates than between cushions of wood, amounting to eleven per cent. of its strength between steel. Making such allowance, the average of the Minnesota granites becomes:—

Average strength of 20 samples of Minnesota granites, unpolished, crushed between wooden cushions. 2-inch cubes. Pounds, per 2-inch cube, 93,272; per square inch, 23,318.

This result is obtained by including the strength of the samples both *on edge* and *on bed*, in one calculation.

The following table shows the same data for 20 New England granites, reported by Gen. Gillmore, the most of them being *on bed*, or undesignated as to whether on bed or on edge. In selecting these, I have chosen the stronger of the New England granites from general Gillmore's table, and in all cases except one (in which the strength *on edge* is reported greater than *on bed*) I have chosen the strength *on bed*, when known. I have avoided every possible error that might be made in favor of the Minnesota granites, and allowed several points that count in favor of the New England granites.

Table

showing the compressive strength of New England granites in 2-inch cubes, as reported by Gen. Gillmore (Report of the Chief of Engineers, 1875, Part II). In unpolished cubes, on wooden cushion-blocks.

		Position.	Strength in pounds	
			of sample.	per square inch.
Blue.	Staten I., New York.	On bed	89,250	22,315
....	Fox Island, Me.	....	59,500	14,875
....	Dix Island, Me.	....	60,000	15,000
Dark.	Quincy, Mass.	....	71,600	17,750
Light.	Quincy, Mass.	....	59,000	14,750
Flagging.	North river, N. Y.	....	53,700	13,425
....	Cape Ann, Mass.	On bed	59,750	14,937
Porter's rock.	Mystic river, Conn.	On bed	72,500	18,125
Gray.	Stony creek, Conn.	On bed	60,000	15,000
Gray.	Fall River, Mass.	On bed	63,750	15,937
Bluish gray.	Keene, N. H.	On bed	41,000	10,250
Bluish gray.	Keene, N. H.	On bed	51,500	12,875
....	Millstone Pt., Conn.	....	64,750	16,187
....	Greenwich, Conn.	....	45,200	11,300
Niantic river..	New London, Conn.	....	50,000	12,500
Niantic river..	New London, Conn.	On edge	56,700	14,175
....	Vinal Haven, Me.	....	52,600	13,150
....	Vinal Haven, Me.	....	67,000	16,750
....	Westerly, R. I.	On bed	58,750	14,687
....	Westerly, R. I.	On edge	59,750	14,937
	Average of 20 granites............................		59,785	14,946

We find here that the

Average strength of 20 New England granites, unpolished, crushed between wooden cushions in 2-inch cubes, is, in pounds, per 2-inch cube, 59,785; per square inch, 14,946.

This shows that the average strength of the Minnesota granites is fifty-six per cent of the strength of the New England granites greater than that of the New England granites.

This anomalous result was so striking that I called general Gillmore's attention to it. The strength of the Minnesota 2-inch cubes was so great that it exceeded the highest registration of the gauge in use, and the samples were not reported at first, but were retained for crushing on a more powerful machine at Boston. It occurred to me that possibly there had been a gradual deterioration in the machine, or in the gauge, so that the registration was uni-

This valuable work is particularly good on the Cladocera, but is unfortunately without Latin descriptions; so that the Swedish text is a hindrance to its usefulness. It is chiefly of historic value now. Large 8vo; Lund, 1855.

Schoedler, J. E., Die Branchipoden der Umgegend von Berlin, 1858.
Smitt, F. A., Sur les Ephippes des Daphnes.
Lubbock, J., An account of the two methods of reproduction in Daphnia, etc.
Leydig, Fr., Naturgeschichte der Daphniden.

The most magnificent work published.

Lilljeborg, W., Leptodora hyalina, 1861.
Sars, G. O., Om Crustacea Cladocera, iagttagne i Omegnen af Christiania, 1862.

This valuable work is difficult of access, printed on thin paper and without illustrations. A second paper by the same author in 1863 is mentioned, but I have never seen it.

Schoedler, J. E., Neue Beitrage zur Naturgeschicte der Cladoceren, 1863.

One of the most important works on the Lynceidæ. The author is rather too credulous and inclined to form new species.

Klunzinger, Einiges zur Anatomie der Daphniden nebst kurzen Bemerkungen ueber die Susswasserfauna der Umgegend Cairo's.
Sars, G. O., Norges Ferskvandskrebsdyr Cladocera ctenopoda, 1865.

The best work on the Sididæ, etc.

Mueller, P. E., Danmark's Cladocera.

One of the most useful books on the subject. Especially good on Lynceidæ and Bosminidæ.

Plateau, Felix, Recherches sur les Crustaces d'eau douce, etc., 1867-69.
Mueller, P. E., Note sur les Cladoceres des Grands Lacs de la Suisse.
Weismann, A., Bau und Lebenserscheinungen Leptodora hyalina.
Sars, G. O., Om en dimorph Udvikling Samt Generationsvexel hos Leptodora, 1873.
Claus, C., Zur kennt. d Organ. u. d. feineren Baues der Daphniden.
Claus, C., Zur kennt. des Baues, etc., der Polyphemiden.
Gruber and Weismann, Ueber einige neue oder unvollkomen gekannte Daphniden.
Weismann, Thierleben im Bodensee, 1877.
Lutz, A., Untersuchungen ueber Cladoceren der umgebung von Bern.
Claus, C., Die Schalendruse der Daphniden, 1874.
Spangenberg, Fr., Ueber Bau und Entwicklung der Daphniden.
Lilljeborg, W., Crust. Suececorum Ordin. Branchiop. et Subord. Phyllop., 1877.
Pavesi, P., Nuova Serei di recherche delia fauna pelagica nei laghi Italiani, 1877-1879.
Grobben, C., Zur Entwicklungsgeschicte d. Moina rectirostris, 1789.
Weismann, Beitrage zur Naturgsch. der Daphnoiden, Leipzig, 1876-79. (Valuable on the physiology).

The American literature may be catalogued in a few lines. The first descriptions and figures with which I am familiar are those in the Rep. of the U. S. Fish Commission, 1874, where S. I. Smith notes **Daphnia galeata**, D. pellucida and D. pulex; also a species of **Bosmina**, **Eurycercus** lamellatus and Leptodora hyalina.

A. E. Birge was the first to systematically study Cladocera in **America**, and his "Notes on Cladocera" furnished a basis upon which to build. A few notes were published by the writer a little later.

A few additional notes and descriptions of new species were published in the *eleventh annual report of the Minnesota geol. and nat. hist. survey.*

Prof. Birge published other notes in the *Medical Journal and Examiner* of Chicago, which I have not seen.

Prof. Forbes of Normal, Ill., in an article in the *American Naturalist*, July, 1882, adds a number of facts and one new species.

In addition to the above, a figure of Sida was printed in one of Hayden's Survey Reports, and some account of the Cladocera of lake Michigan was given by B. W. Thomas, I believe, in one of the official reports of the Chicago Water Commission.

CLASSIFICATION OF THE CLADOCERA.

SUB-ORDER I.—CALYPTOMERA (membrane-clothed).

Body enclosed in a bivalve shell. Mandibles truncate below. Maxillæ distinct, spiny. Thoracic ganglia discrete.

TRIBE I.—CTENOPODA.

Feet six, similar, foliaceous, all distinctly branchiate.

FAM. 1.—SIDIDE.

Swimming antennæ with two unequal rami, intestine simple.

FAM. 2.—HOLOPEDIDÆ.

Swimming antennæ simple, elongate cylindrical (in the male prehensile), intestine with two lateral dilations.

TRIBE II.—ANOMOPODA.

Feet five (or six) pairs, the anterior pair more or less prehensile and destitute of branchiæ.

FAM. 1.—DAPHNIDÆ.

Rami of antennæ three and four-jointed, five pairs of feet, the last with a curved appendage guarding branchial sac; antennules of female short, one-jointed.

FAM. 2.—BOSMINIDÆ.

Six pairs of feet, antennules elongated, many-jointed.

FAM. 3.—LYNCODAPHNIDÆ.

Antennules of female elongated, but one-jointed; intestine simple or convolute.

FAM. 4.—LYNCEIDÆ.

Antennæ with both rami three-jointed, intestine convolute, with abdominal but no anterior cæca.

SUB-ORDER II.—GYMNOMERA (destitute of covering).

Body without or nearly destitute of bivalve shell; feet not branchiate, spiny. Anterior thoracic ganglia in one mass.

FAM. 1.—POLYPHEMIDÆ.

Abdomen curved, terminating in two long stylets.

FAM. 2.—LEPTODORIDÆ.

Abdomen straight, ending in short claws.

FAMILY SIDIDÆ.

Head separated from the body by a depression, without prominent fornices (or spreading shields) over the base of the antennæ. First pair of antennæ, or antennules, as we shall uniformly call them, one-jointed, usually rather small in the female, but extending into a very strong flagellum in the male. Antennæ long, biramose, with unequal branches. Mandibles truncate at the end. Maxillæ armed with large spines. The form is usually elongate, and the abdomen often extends beyond the edge of the shell behind. The male openings are usually in the end of long appendages which depend from the base of the post-abdomen. This interesting family is represented in America so far by four species, one of which constitutes a new genus. Others will undoubtedly be found upon a careful study of the fauna of the great lakes Most of the species prefer the clearer and colder water of large lakes. The processes of development, as traced by the writer, vary very little from the method exhibited by Moina. The ephippial condition, however, is not found in these animals which are less subject to destructive influences of the climate. They do, however, produce so-called winter eggs which are laid in October and are distinguished from the summer eggs, which hatch in the brood cavity, by a brown color and the presence of fatty spheres. These eggs are produced in large numbers in distinction from most other Cladocera in which the winter eggs are very few. These eggs are permitted to settle to the bottom and there develop at the proper time. Sida crystallina is often found in immense numbers in large lakes which contain abundant plant growth. The size, and especially the reproduction activity, is very dependent on the environment, and hence little success is obtained in preservation in aquaria. Some of the genera are nocturnal and should be sought at the surface on quiet evenings.

I.—GENUS SIDA. Straus.

(Plate N. Figs. 12-14.)

Body elongate, hyaline. Head small, quadrate. Fornices absent. Antennules of female small, truncate; of male, with a long

Sp. 1. Pseudo-sida bidentata, Herrick. (Sp. n.)

(Plate K. Fig. 9.)

Post-abdomen armed with 12–14 clusters of spinules in a transverse row; the terminal claw armed with two long basal spines, and with numbers of fine teeth on the inside. The two-jointed ramus of the antennæ has six setæ on the basal, and ten or eleven on the terminal joint, while the three-jointed ramus has a short terminal joint bearing three spines. The valves are marked with sparse spines on the lower margin. In most respects this species is like Sida, which it resembles in size. In the form of the female antennæ it is like Latona which it also somewhat resembles in the number of joints of the antennæ and the numerous setæ they bear. It is certainly an interesting transition form. Found only in swamps bordering Mobile bay, Ala., but whether in brackish or fresh water my notes do not inform me. Sida crystallina lives far out in the bay, and Daphnella is found in pools along shore.

III.—GENUS LIMNOSIDA. Sars.

(Plate N. Fig. 9.)

Head crested; eye in a conical prominence. Shell elongated, produced above in an acute angle. Antennules small, truncate in the female; in the male of enormous size; antennæ very long. Post-abdomen smooth; terminal claw spiny.

The one species, L. frontosa, Sars, is not yet known in America.

IV.—GENUS DAPHNELLA. Baird.

Neither beak nor fornices present. Antennules of female small, truncate; those of male long, flagellate. Antennæ with two-and three-jointed rami. Male with a hook on the first foot, and large copulatory organs attached to the base of the post-abdomen.

Sp. 1. Daphnella brachyura, Lievin.

Sida brachyura, LIEVIN, Branch. d Danziger Geg.
Daphnella wingii, BAIRD, Brit. Entom.
Sida brachyura, LILLJEBORG, De crust. ex ord. trib.
Diaphanosoma brandtianum. FISCHER. Erganzig. Berichtig.
Daphnella brandtiana, SARS, Norges Ferskv.—Krebsdyr.
Daphnella brachyura, P. E. MUELLER, Danmark's Cladocera.
Daphnella brachyura, LUTZ, Untersuchung u. die Cladoceren d. Umg. v. Bern.
Sida brachyura, PAVESTI, Nuova serie di recerche della fauna pelagica nei laghi Italiani (L. Trasimene).
Daphnella brachyura, HERRICK, Notes on Crustacea of Minnesota.
(Compare also *D. expinosa*, BIRGE, Notes on Cladocera p. 3.)

The species of Daphnella found about Minneapolis, occasionally abundant, seems not to differ in any important character from European types of D. brachyura, although I formerly regarded it as distinct (D. winchelli, Microscopic Entom., Addenda).

Head less than ½ the body (about .27 mm., while the body is .6 mm. long); eye about ¼ head; antennæ when reflexed extend a little beyond ⅔ the length of body. Male, .7 mm. long; antennæ reflexed, reaching base of shell; anterior antennæ extremely long; copulating organs reaching nearly to end of claws. Having carefully compared our specimens with the descriptions and figures given by Birge for his D. expinosa, the evidence seems to indicate not only that they are identical, but both are really D. brachyura. The distinctive characters of D. expinosa are a greater indentation between head and body, absence of caudal teeth, greater length of male appendages, and the opening of the vasa deferentia below the "instep" of these appendages.

The absence of teeth upon the post-abdomen is of even generic importance according to Sars, who gives it in his synopsis of genera as typical for Daphnella. In our specimens the claws are at least pectinate if not serrate, while the appendages of the male reach generally nearly to the middle of the claws. The relative length of these appendages and the antennæ of the male is variable.

Sp. 2. **Daphnella brandtiana**, Fischer.

Head as long as half the body, antennæ when reflexed reaching beyond the posterior margin of the valves. Length 0.8 mm. Of the validity of this species we can form no conclusion. It is usually considered a variety or phase of the above.

v.—GENUS LATONA, Straus.

(Plate N. Fig. 8.)

Body elongate, broad; head large and square, appendaged below with triangular laminæ; fornices present. Antennules rather large. The larger ramus of the antennæ is two-jointed and has an expanded process at the base. The lower posterior angle of the shell has a peculiar diverging set of setæ. The shell is often ornamented with numerous flecks of bright color. There is a copulatory apparatus in the male.

Latona setifera, Mueller,

Is the only species, and is not yet recognized in Minnesota, but was found by Prof. Birge in lake Michigan.

FAMILY HOLOPEDIDÆ.

GENUS HOLOPEDIUM, Zaddach.

(Plate N. Fig. 11.)

The peculiar animal bearing the name Holopedium gibberum has the brood cavity greatly elevated, and the whole upper part of the animal is covered by a jelly-like mass secreted as a protection or float. The antennæ are simple in the female and extend through a slit in this covering. In the male they are prehensile and have rudimentary inner rami. It would be difficult to recognize the affinity of the female with its monstrous form were it not for the male and particularly the development history. Found in this state probably only in lake Superior. Forbes mentions it from lake Michigan.

FAMILY DAPHNIDÆ.

The family Daphnidæ contains the genera Moina, Ceriodaphnia, Scapholeberis, Simocephalus and Daphnia, which include the commonest, as well as some of the largest, Cladocera. The genera may be distinguished by the following table:

I. **Head rounded, not beaked; antennules long in both sexes, shell not covering the end of the abdomen..........................*Moina*.**
II. **Head rounded; antennules rather short; shell enclosing whole body..*Ceriodaphnia*.**
III. **Head somewhat beaked below, shell angled below or extending in long spines from the lower angle, pigment fleck roundish...*Scapholeberis*.**
IV. **Head beaked below; shell rounded below, with a blunt spine above: pigment fleck elongate......................................*Simocephalus*.**
V. **Head beaked below; shell extending in a sharp spine at the upper posterior angle; pigment fleck small..............................*Daphnia*.**

THE CIRCULATORY SYSTEM OF THE DAPHNIDÆ.

In the *Daphnidæ*, and, indeed, the Cladocera in general, we meet an instance of great development of surfaces at the expense of solidity of form and compactness of organs. The whole body is composed of an aggregate of laminæ, and the appendages all approximate more or less toward this fundamental modification. Thus, for example, the head is a leaf-like body with a laminate shield above and a pair of flat organs beneath. The abdomen terminates in a knife-like post-abdomen, while the thorax, with its narrow form, foliaceous feet and, far more, the enormous development of the outer wall to enclose, more or less fully, the entire body, is the typical illustration of this fact. Necessarily this structural modification exerts a formative influence on the internal organs which are all more or less influenced by it; and this is peculiarly the case with the more external and, in general, the paired organs. Thus the "shell glands," so called, which in Copepoda are generally coiled tubes, become here greatly flattened organs closely united with the shell. The physiological result of this modification is the sensitiveness to changes in the environment, which is universal among the *Daphnidæ*. The compact Copepoda survive the vicissitudes of confinement with comparative immuity, but the first taint in the water destroys the delicate organism of *Daphnia*. The cause for this may be found in the exposure of the most vital and delicate parts of the organism to the influences of the surrounding aqueous medium. In particular the circulatory and respiratory systems, which here are not easily to be distinguished one from the other, constitute a relatively very large area of close contact with the water. It thus happens that the central organs are influenced in a very short time by whatever deleterious substances may be disseminated in the water.

Notwithstanding this lack of centralization, the structure of these animals is of a very considerable degree of complexity and, presenting so many instructive modifications under circumstances so favorable for study, has been very thoroughly investigated. The very transparency which has made it possible to clear up many questionable points in crustaceology from the lessons learned in *Daphnia,* has rendered the investigation of certain sets of organs extremely difficult, and among these may be mentioned the circulatory system. The circulation of the nutritive fluid and the general facts connected with the heart were indeed early understood; but there remains many a detail and some important relations which are as yet either imperfectly known or entirely misunderstood. The following notes are offered as a contribution to the, as yet incomplete, knowledge of the circulatory apparatus.

The observations were confined for the most part to *Daphnia schæfferi* and *Simocephalus vetulus*, with occasional comparisons with *Eurycercus*, *Pleuroxis, Pasithea* and others. It is greatly to be desired that the study might be carried to the Sididæ, in which the larger size and superior transparency would doubtless reward the search with several, as yet doubtful details. The circulation of the nutritive fluid in the Daphnidæ, then, is somewhat complicated, but may be divided into a superficial and a deep system. It must be remarked that this distinction is arbitrary and only used for its convenience.* The one extends over the entire inner surface of the carapace, while the latter is in close relation with the vegetative organs, and extends into the branchial vessels of the feet. The nutritive fluid which is normally colorless and supplied with corpuscles of organized nutriment, (it seems doubtful if they should be called blood corpuscles) is confined for the most, if not its entire, course within membranous walls of connective tissue which, however, instead of assuming a definite form as "blood vessels," for the most part conform to the contour furnished by the firmer organs.

This membrane which is frequently folded upon itself and invests the body walls and the inner organs, is in some places free, and may be seen as a pulsating, swinging film, or, more frequently, it can only be detected as a swaying line (seen in optical sections), thus giving rise to the misapprehension that one is dealing with a thread, or as moving grains, in which case the film is itself invisible but its presence is indicated by the attached grains of protoplasm. About the heart the free swaying portions of this membranous layer are so numerous as to render it almost impossible to distinguish the essential from the accidental appearances.

This membrane must serve the most various purposes; aside from the mere retention and direction of the blood currents, it is often transformed into a branchial surface. At definite points it becomes the bearer of the cells which were above mentioned as grains of protoplasm. These are most numerous in young and well-fed animals, and in particular in gravid females, while, on the contrary, mature males and females after the escape of the young, are nearly devoid of such bodies. These are most numerous in angles of the membrane, particularly about the heart, shell glands, ovaries, intestine and the branchial spaces in the feet.

These cells vary in size from that of the blood corpuscles to larger cells with nuclei of comparatively very large size. It would be too much to say that such cells are developing blood corpuscles; but that they are reservoirs of nutriment which serve to supply the increased demand upon the blood in exigencies of the existence of the animal, cannot be doubted. It is a well known fact that the number of blood corpuscles, so called, likewise varies, and apparently under the same conditions. It seems altogether probable that the two facts may be considered as supplementary, *i. e.* that the same process of depauperating of the blood, which deprives it of its corpuscles in an earlier stage, lays waste those supplies laid up in the cells referred to (whether by their actual separation as blood corpuscles or simply desolving of the contained material is of little importance). These cells also are thus paralellized with the "oil globules" of *Copepoda*. In such copepods as *Cyclops* and *Canthocamptus*, which appear to have no differentiated heart, there are always present drops of colored fluid, which are most numerous in well-fed and pregnant specimens. These drops occupy the same relative position as the blood globules of other Crustacea, *i. e.*, they lie within a very thin membrane corresponding to the vascular walls of other animals. This membrane, in general, invests the alimentary canal, as can be very readily seen in the abdomen, where it encloses a considerable space about the intestine, which is filled with fluid, investing more or less completely the muscles and other organs. As there is no rapid circulation of blood, these "oil drops" are comparatively stationary, and yet are moved slowly by the constant contraction of the walls of the alimentary canal which, in the anterior part, or stomach, are thick and glandular, while in the abdomen they seem to be more fitted for respiratory function.

The above arrangement in *Cyclops* is correlated with its compact habit and thick carapace, and forms a simple starting-point for the study of the circulatory system in arthropods. It seems that the walls of the membranous blood cavity are themselves also, in places, furnished with muscles, so that the fluid is not dependent entirely on the vermiform or the peristaltic motions of the intestine for its escape from stagnation. If this be correct, we here have an indication of the origin of the central organ of the circulatory system.

But to return to Daphnia, the heart lies in the dorsal region over the intestine upon which it may be said to ride, as it were astride, though as we shall see, it is separated from the intestine by other organs. In *Eurycercus* this is most evident, as here the heart is more obviously bifurcate.

The heart and circulation in Daphnia has been described more or less at length by many authors, in particular *Claus* (Zur Kenntniss der Daphniden und verwanter Cladoceren. Zeitsch. f. Wiss. Zool. Bd. xxvii.) and *Gruithuisen* (the work of this author I have not seen), while *Weismann* (Ueber Bau und Lebenserscheinungen von Leptodora hyalina, 1874) describes the heart of Leptodora, and *Claus* (Zur Kenntniss des Baues und der Organ. der Polyphemiden), that of the Polyphemidæ. Other authors, except *G. O. Sars*, who elucidates some points in the circulation of blood in Sida, seem to have added little or nothing to our knowledge of this interesting subject.

As already often described, the heart occupies a place in a definite space—*the pericardial chamber*—the summit of which is the dorsal shield which, we believe, should be distinguished from the remainder of the so-called cephalic shield. (It is usual to describe the shell of Daphnia as consisting of a bivalve posterior portion or *ormostegite*, and a simple anterior *cephalostegite*; but it seems much more proper to consider that portion of the shell which covers the pericardial space, and is the point of attachment of the powerful muscles of the abdomen and of the membranous walls of the pericardium, as a distinct portion of the carapace, as it often evidently appears through the presence of a distinct suture, or, in its absence, through the peculiar sculpture of the shell. In such case it might also be proper to distinguish two regions on the lateral appendages of this dorsal shield, an upper and a lower, separated by the more or less obvious line, extending from the union of the lateral lines of the dorsal and cephalic shield in nearly a straight line toward the posterior portion of the shell, and indicating the insertion of the muscles which move the feet and post-abdomen. The lateral walls of the pericardial space are the shell-walls themselves, and the floor is formed by a membrane supported on, and investing in part, the strong muscles which connect the abdomen with the upper anterior part of the dorsal plate. Thus a space is left between the pericardium and the intestine which is occupied by a special blood sinus leading toward the posterior and lower part of the abdomen. The posterior wall of the space is formed by a chitinous partition which bounds the brood space, or its homologue, and is connected by chitinous processes (stutzbalken) with the outer skeleton. The anterior, on the other hand, is only bounded by the supporting ligaments of the abdomen above described and membranous partitions. As usually described, the heart lies suspended in the cavity thus defined, by slender muscular threads, more or less like those of the heart of *Corethra* larvæ and the like; and such seems to be the case at first, but a more careful study shows that this is far from correct. On the contrary, the chief supports of the heart are membranes which, seen in cross-section with the attached grains or blood globules, assume the appearance of exceedingly slender structureless threads. The action of re-agents indicates that these supposed threads are not muscles, but composed of connective tissue; while by changing the focus the sharpness of the line is frequently not altered, but *its relative position is changed*,—a simple test which often serves to dispel an illusion of this sort. That there are some threads of the character above mentioned is not to be doubted, as in connection with the valves of the heart; but the proper support of the heart is found in the membranes which invest it in part, and are reflected upon the walls of the shell and, anteriorly, of the intestine. It is not yet possible to fully describe the insertion of these tissues, as there is so large a number, especially about the anterior opening, where they lie in all directions and at all angles, and are so transparent, that only their vertical sections appear as dark lines. Thus the same membrane appears and disappears, only to re-appear in a different position where it might be readily taken for a distinct membrane. In general, however, I hope to make no serious error in the following summary. Before going into detail, however, it will be necessary to consider the intimate structure of the heart, as well as its general shape and position.

The general shape is that of an irregular oval with the greatest convexity posterior (*Daphnia*, *etc.*), or it may be strongly bifid and thus somewhat Y-shaped *(Eurycercus*, *etc.)*. It is held in position in the pericardial cavity by the membranes above alluded to, to which it is attached at definite points, the principal of which are two slight enlargements on the lower posterior portion, which are in part opposed to each other and also to a superior posterior point of insertion. All three of these points are thus held in relation with the shell with which the attached membrane is connected on either side below and above. The membrane then extends part way along the heart wall towards the anterior and is then reflected to the shell wall. The result of this is that the pericardial space is an angular cavity opening in front. It would seem as though the membrane attaching the heart were identical with that lining the cavity itself. The heart proper is obviously composed of series of muscular elements, which are considered as simple cells by Claus, and which in young individuals show very destinct nuclei of comparatively large size. These are arranged like the meridian lines of a globe uniting above and below, thus forming the most effective apparatus possible for contracting the heart. In the smaller Daphnidæ, as stated by Claus, there seems to be but a single layer of muscular rays, but in D. schæfferi and Simocephalus I have repeatedly satisfied myself that some of the longitudinal rays sink below the others and form a series of *longitudinal muscles*, as stated by earlier writers. These are furnished with a nucleus which is frequently more or less external, appearing like a spherical appendage. In *Leptodora* Weismann has shown the heart to consist primarily of a membrane of connective tissue, upon which the muscular fibres or cells sit in somewhat the same position as in Daphnia, except that there is not the same regularity in the arrangement. There are many considerations which would lead us to expect the same structure in Daphnia, though it is not yet demonstrated; and the structure of the anterior opening seems to point in the same direction. At any rate there is a close connection between the muscular and connective parts of the heart. We have, then, in the heart of Daphnia a highly developed apparatus for closing it, but apparently none for its opening. This certainly is not accomplished by the few fibers which connect the heart with the shell, the very contractility of which is doubtful. Nay, more, these are insufficient even to hold it in its place in the cavity. Still less can we assume that the heart, from any inherent power, can open itself. This must be explained by the operation of two factors which are interdependent, *i. e.*, the elasticity of the supporting membranes and the unequal pressure of the blood in different parts of the body. 1. The membranes which support the heart are attached not at right angles, but, on the contrary, in a direction more nearly parallel to the walls of the heart, and thus whatever elasticity they possess is greatly increased; and the diminishing of the size of the heart draws these membranes out of their position at the expense of their elasticity, which tends to restore them to their original position when the pressure is removed, in the same way a drum-head returns after a blow to its normal position. This factor is, however, only operative so long as the whole system of membranes to which these belong is distended with fluid. If this blood cavity be punctured, the fluid flows out and the heart shrivels. It may continue to beat for some time, but it will be seen that the effort consists simply in a vigorous contraction which is followed by no perceptible enlargement. 2. After the systole the blood of the heart is forced toward the head, whence it is prevented from re-entering the pericardial space directly by the valves and the membrane enclosing the arterial blood. The pressure is therefore increased in all parts of the system, except the pericardial chamber where it is greatly diminished. The membranes supporting the heart are thus unusually tense, and the muscular effort having ceased, the walls of the heart are distended, and blood flows in in the direction of the least resistance through the two lateral openings or ventral valves of the heart. The contraction of the heart during the systole is not simultaneous in different parts, but begins by the contraction of the posterior part where, being nearly free, the motion is more marked. At the close of the systole the heart is irregularly contracted, the points of attachment above described being more distended than the remaining portions. The anterior of the heart is rendered very difficult to study by the fact that its opening is covered by the muscles of the mandibles and obscured by the many supporting and vibrating membranes alluded to.

It is, however, suspended by two folds of membrane which I have been inclined at times to believe blood-vessels through appearances resulting from the confused currents flowing about them. The upper margin is also attached by a pair of cords directly to the superior part of the shell. The anterior opening or arterial valve is most perplexing, and the following description which applies only to Daphnia schæfferi must be subject to some doubt. It appears however that it has been in a measure misunderstood by previous writers, and namely by Claus, who compares it with that of Leptodora, which if correctly described by Weismann, is not at all identical in form, but quite comparable with one of the sides or lips of the venous opening. It does not seem to be connected by a thread, as stated for *Leptodora*, with the aortal bulb, for in reality there is no aortal bulb; the heart simply is connected with the system of membranes which more or less inclose the system. The floor of the so-called aortal space is a membrane which separates the outflowing stream from a current which flows toward the abdomen and passes directly under the arterial opening, so that it appears as though there was a stream entering the heart from before as well as at the sides; the arterial opening being nearer the dorsal part of the heart than is naturally expected, and the slight enlargements at the attachment of the supporting membrane favoring the impression that there is here a veritable opening. The out-flowing blood stream is bounded at first by the membrane above mentioned, which is farther on reflexed onto the shell and intestine so that the streams in the head flowing just under the shell are separated from the deep dorsal stream flowing from the heart.* This main current passes to the region of the eye between the horns of the cæca of the alimentary canal, and thence beneath the stomach, and here divides, part becoming external and a deeper part passing under the intestine, thence in front of the heart, flows into the deep sinus which, as before said, passes beneath this organ. Other portions of the returning stream flow around the angle of the union of the head and body and constitute a stream just above the feet in which the current flows vigorously.

Yet other portions flow into the region of the shell-gland and are united with blood which here passes through the numerous sinuses described by Claus as surrounding this organ (Die Schalen-

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*In *Pasithea rectirostris* this septum is easily seen as a swaying membrane, which near the eye is reflexed to the top of the shell.

druse der Daphnien) and thence flows into the abdomen, uniting with the other two streams. A part also of the current in the head flows into the antennæ where it follows a deep course through the basal joint in which the corpuscles may be seen to emerge to the surface from two points where are spaces between the powerful muscles, the first being near the base and the second near the extremity of this joint, and then to return and join the superficial current.

The corpuscles appear to enter the rami very rarely if at all. That part of the superficial stream which reaches the interior of the pericardial chamber passes between the muscles of antennæ and jaws and seems to find its way into the great current beneath the heart, though I have also thought to have seen it flow directly into the pericardial space as the lateral superficial streams do. That part of the superficial stream which reaches the posterior margin of the shell returns through a canal formed by the walls of the shell and the brood-space, between the "stutzbalken" of which the blood corpuscles can be seen to glide more rapidly than in the free lateral spaces.

Lastly, it only remains to follow the fortune of the strong stream flowing along the neutral surface of the abdomen. The strong current flowing beneath the heart enters a broad sinus which lies over the intestine and extends for over a third of its length, where its walls unite with the surface of the intestine above and thus open downward on either side.

The stream thus directed flows toward the openings of the base of the feet. The structure of the branchiæ has not yet been clearly described. Instead of nearly spherical or oval chambers they are really tubes which connect, on one hand with the opening above, and below with the general cavity of the limb, whence the blood returns to the abdomen. The current is very rapid through these tubes. The blood having been returned to the abdomen, courses in the well known manner through the post-abdomen and flows over the intestine, thence over the back-flowing stream to the posterior lower opening of the pericardial chamber.

The study of the actions of the heart is rendered more difficult by the fact that in order to secure the greatest possible transparency, the living animal must be covered and a little pressure applied, which is frequently attended with abnormal variations of the circulation. In particular if the usual exit of the blood be stopped by the cæca of the intestine, as is frequently the case, the operation of the heart may be reversed, when a vigorous stream may be seen to enter the arterial opening and emerge from the ventricles. This process would be impossible if the anterior valve were as described by Claus and Weismann; while being really more like the venous valves, it is easily and frequently permitted. The current of the blood in this case stagnates except near the heart.

The rapidity of the pulsations of the heart varies with age and condition of rest or motion.

In D. schæfferi this variation may range from about 150 per minute to perhaps 250, 200 being probably a fair average. In a young Simocephalus I have observed a heart beat 300 times in a minute. Again, in a specimen of D. Schæfferi at rest the heart was beating 170, but during the spasmodic motion of feet and antennæ the pulse rose to over 200.

I.—GENUS MOINA. Baird.

The systematic position of this genus has been the theme of some discussion. it being claimed, with good reason, that there are many resemblances to the Lyncodaphnidæ (P. E. Mueller considers it a transition to the Bosminidæ and lyncodaphnids); on the other hand, Leydig and Kurz regard it more closely allied to the Sididæ, with equally good reason. The long antennæ, long narrow antennules and many peculiarities in form, etc., suggest the macrothroid crustaceans; the extended abdomen and especially the location of the male seminal opening are like Daphnella, which Moina resembles in motion and habit very strikingly. The absence of the pigment fleck is no more a characteristic of the Sididæ than of other groups. After all has been said, the immediate affinities of the genus are acknowledged to be with the Daphnidæ.

The true place of the genus, as it appears to the writer, was hinted at by Birge (Notes on Cladocera). Moina seems to be the pivotal point of the Cladocera, at least of the families above mentioned. Without going into phylogenetic speculation, it is suggestive that this genus can and does by preference live in very impure water and may therefore have had an early origin. From Moina diverges the stem of the Daphnidæ by way of Ceriodaphnia, Simocephalus and Daphnia. These two latter genera are intimately connected by Simocephalus daphnoides, Herrick. Scapholeberis is connected with Ceriodaphnia through S. angulata, Herrick. The Sididæ seem to diverge by the way of Daphnella, through which by means of Pseudo-sida the genus Sida is reached, and finally Limnosida, Latona and Holopedium. The relationships of the curious Polyphemidæ are less evident.

5317	Nov. 1883.	Geol. & Nat. Hist. Survey	Red quartzyte	2	Sec. 8, Delton, Cot. Co.	Potsdam	N. H. Winchell.	
5318	"	" "	" "	1	Sec. 9, " " "	"	"	
5319	"	" "	" "	1	" " " "	"	"	
5320	"	" "	Upper surface of the Jordan sandstone under the Cret. clay	2	L'Huillier Mound, South Bend	Cambrian	"	
5321	"	" "	Surface of the Shakopee limestone, coated with a ferruginous crust	1	Mankato	Shak. & Cret.	"	
5322	"	" "	"Blue stone"	6	" "	Shak.	"	(J. R. Beatty's quarry).
5323	"	" "	Hydraulic shale	5	"	"	"	" "
5324	"	" "	Hydraulic limestone	8	"	"	"	(Standard Cem. Company).
5326	"	" "	Hydraulic cement	Two quarts	"	"	"	" "
5327	"	" "	White clay between the Shakopee and Jordan	Much	"	Cret.	"	" "
5328	"	" "	" " "	"	South Bend	"	"	(L'Huill. Mound)
5329	"	" "	" " "	"	Mankato	"	"	(Cement Company's quarry).
5330	"	" "	Red clay	"	"	"	"	(Near Indian lake).
5331	"	" "	Red shale	"	New Ulm	Dakota	"	(Winkelmann's).
5332	"	" "	Limestone	2	"	Niobrara	"	"
5333	"	" "	Shaly limestone	1	"	"	"	"
5334	"	" "	Calcite (nail-head spar)	2	"	"	"	
5335	"	" "	Conglomerate (ferruginous)	2	Mankato	Dakota	"	(Near Red Jacket R. R. bridge)
5336	"	" "	Oolitic chert in conglomerate	2	"	"	"	" "
5337	Oct. 1883.	" "	Magnesian limestone	1	Sec. 20, Frankford, Mower Co.	Devonian	"	(Aaron Bush's quarry).
5339	"	" "	" " underlying the "Le Roy rock"	1	¾ mile N. of Le Roy village	"	"	(In the bed of the creek).
5343	"	" "	Conglomerate (ferruginous)	3	Sec. 13, Frankford, Mower Co.	Cret	"	
5344	"	" "	Shale (whitish)	1	1½ ms. north of Grand Meadow	"	"	(Beside the road).
5346	"	" "	Silicified wood, 75 feet below the surface	1	Sec. 8, Lakeville	Drift	"	(From a well).
5347	"	" "	Copper (2 inches square, ⅛ in. thick)	1	Rosemount	"	"	

AINED.	NAME.	No. of specimens.	Locality.	Formatio
Whence.				
eol. & Nat. Hist. Survey	Sand (from the drift)	Much	Minneapolis	Drift .....
resented	Hydraulic cement	1	Rosendale, N. Y.	....
"	Manufactured peat..........	Much	Near Coon creek, Anoka Co.	Recent. ..
"	Gray limestone, with dendritic markings	60	20 miles N. of Gallatin, Montana.....	....
"	Mass (2 feet long) of calcite crystals	1	" " "	....
"	Silver ore; big San Juan mining district	3	Near Ophir, San Miguel Co., Col.	....
"	Magnesian limestone, hammer-dressed	1	Near Winona	St. Law ..
"	Pipestone, in part purplish-gray	1	Pipestone City	Potsdam
"	" " " "	2	" "	" .
"	" purplish gray.	1	Baraboo, Wis.	" .
eol. & Nat. Hist. Survey	Magnesian limestone, pink.	12	Kasota	Shakopee

V.

CRUSTACEA.

C. L. HERRICK.

THE GEOLOGICAL AND NATURAL HISTORY SURVEY OF MINNESOTA.

N. H. WINCHELL, STATE GEOLOGIST.

A FINAL REPORT

ON THE

CRUSTACEA OF MINNESOTA

INCLUDED IN THE ORDERS

CLADOCERA AND COPEPODA,

Together with a synopsis of the described species in North America, and keys to the known species of the more important genera.

By C. L. HERRICK, Assistant in Zoology.

MINNEAPOLIS:
JOHNSON, SMITH & HARRISON.
1884.

PREFACE

IN presenting what may be denominated a final report of the work done in this state upon the group of crustacea best represented, and, all things considered, most important, the author must admit that the term "final" refers only to his own opportunities and the limitation of time imposed by circumstances.

While a comparatively large proportion of all the species existing within our limits have been examined during the progress of these investigations, there undoubtedly remain many additional and curious forms to reward the search of the student. A great variation in the degree of completeness with which the different genera and species have been treated will be observed, due in part to the circumstances under which they were studied, and frequently to the poverty of material. The entomostracean fauna is quite different at different seasons, and a complete knowledge of even our local fauna requires a long period of observation. Even the dead of winter is a favorable time to study some groups. The late autumn is, perhaps, the most favorable opportunity; for then, in one group, the sexual activities are just at their height, and both sexes may be studied. A number of cladocera are restricted to this season. There are a number (how large it is not yet possible to tell) of species in both groups which are to be sought by night though no phosphorescent species are yet known. Our larger, and, especially, deeper lakes have a quite different fauna from the shallow pools and rivers. In general, the flowing waters are poor in entomostraca. The cladocera or shelled entomostraca, have here received a large share of attention, and more particularly the Lynceidæ, which are the most minute of arthropods. This study has been rewarded with an unexpectedly large number of forms, and a particularly large number of species identical with those of Europe and elsewhere. Prof. Birge is the only American writer who has attempted this group, and his valuable work has made us familiar with the more striking new species. A few new species are included in our list and several varieties hardly yet known in Europe. The remarkable Monospilius is among these. This animal has but a single larval eye in the middle of its forehead, and clumsy, and the continuation of the fornices runs toward the apex of the incurved beak, which commonly lies within the valves of the shell. The lower anterior angle has a prominence and there is a basin-shaped area inclosing the base of the antennæ, part of which lies on the shell and part on the head. This area is more strongly lined or reticulated than the rest of the shell. The lower margin is straight and terminates, in most forms, in a long scythe-shaped spine which is directed backward. The shell itself is usually indistinctly reticulate or unmarked, and commonly is deep colored. The post-abdomen is very like Ceriodaphnia or more as in Simocephalus; the anal spines are few and the older specimens have more than the young; the place at which additional spines are to appear is marked by prominences. The eye is of moderate size, the pigment fleck rather small and the antennules short and hidden by the beak. The antennæ are of small size and generally dark colored. The ephippium contains but one egg; the males do not have altered antennæ or feet. The sexual periods fall in early summer and in autumn, according to Weismann; the males appear but sparingly. The species S. mucronata is very abundant everywhere, while the others are less frequently seen.

Sp. 1. **Scapholeberis mucronata,** Mueller.

(Plate J. Fig. 5.)

Daphnia mucronata, MUELLER, LEIVIN, LILLJEBORG, FISCHER, LEYDIG, BAIRD, HERRICK.

Scapholeberis mucronata, SCHOEDLER, P. E. MUELLER, KURZ, WEISMANN, BIRGE, HERRICK.

This well-known species with rather short spines below is found abundantly everywhere. In this country at least it is characterized by a dark color. The head is large, rounded in front of the large eye, serrate below and extending posteriorly into a roundish beak, back of which are the short antennules. The fornices are very short and rounded; a line connects the fornices with the beak by a sudden deflection downward; it sets off the area which forms a part of the basin of the antennæ. A second line springing from just above the termination of the fornices passes over the eye by a broad curve. The post-abdomen is truncate and bears beside the terminal claws four or more spines which rapidly decrease in size. The claws are minutely spined; the spines on the shell are of variable length, but do not exceed one-fourth the length of the remainder of the lower margin. This species ranges over all Europe and eastern United States.

Length 0.6 mm.—0.8 mm.

INTRODUCTORY.

"Evading e'en the microscopic eye,
Full nature swarms with life ; one wondrous mass
Waiting the vital breath, when Parent Heaven
Shall bid the spirit blow. The hoary fen,
In putrid streams, emits the living cloud
Of pestilence. Through subterranean cells,
Where searching sunbeams scarce can find a way,
Earth animated heaves. The flowery leaf
Wants not its soft inhabitants. Secure
Within its winding citadel, the stone
Holds multitudes. * * where the pool
Stands mantled o'er with green, invisible
Amid the floating verdure, millions stray.
* * Nor is the stream
Of purest crystal, nor the lucid air,
Though one transparent vacancy it seems,
Void of their unseen people."—*Cowper.*

To the poet only, and the man of science, is it given to meet these "unseen people" on those familiar terms which warrants the use of the word intimacy; yet may not we who, like Sam Weller, find our "vision limited," because we have only eyes, avail ourselves of the kind introduction these people give us, and shake hands, as it were, though perhaps a little stiffly, with our neighbors, the unseen people.

Whether we like it or not—Cowper intimates we shall not—these people, in one way or another, touch us constantly, and like diminutive sprites are ever active in hatching mischief or doing their little favors to humanity. Happily most of these are amiable goblins, and are tireless in endeavors to secure us against our insidious enemies of their own ilk. With your permission we will draw the curtain which separates us from the naiades of our pools and streams.

The numbers of living forms to be found in any pool is a constant surprise even to the student of this subject, and the variety and unique character of the animals, particularly, cause a constant flow of wonder and admiration. Confining ourselves to the crusing of the vas deferens close behind the terminal claws; mucro short and blunt, length 1 mm. This species is very near the next, but differs in several particulars. It forms the transition to the next, which is the extreme of the genus in a direction converse to that pursued by the S. armata.

Sp, 5. Scapholeberis angulata, Herrick.

(Plate B. Fig. 9. Plate T. Fig. 7.)

American Naturalist, 1883.

Form as in the above, but comparatively larger; valves quadrangular, anterior margin strongly arched; head short, only slightly concave below the eyes; the beak is as in S. nasuta, but seems to be directed more nearly directly downward than in that species. The antennules are long and resemble those of Simocephalus. The pigment fleck is square and rather large; the antennæ are of the usual size. The reticulated areas are as in the other species. The post-abdomen is more as in Daphnia, not so squarely truncate and with five to seven large teeth; the first foot has one elongated jointed seta; the posterior angle of the shell has no spine, at most there is a somewhat prominent acute angle, the inner shell layer is armed at this point with some elongated teeth as in the corresponding situation in Simocephalus. On the whole, there is a similiarity to that genus in this as well as in the previous species. S. nasuta has a short spine and elongated pigment fleck; the present species has a squarish but rather large fleck and no spine; the post-abdomen has a greater number of spines than any other species. South of Tennessee river, in Alabama and Mississippi.

The species of this genus are predominatingly American, four out of the five being found in the United States; the fifth, moreover, is more often regarded a variety of one of the others; in fact, the absence of S. cornuta from America is one of the most important supports of the specific independence of the two forms. All the species delight in disporting themselves near the surface in sunny weather.

IV.—GENUS SIMOCEPHALUS.

Although a very well circumscribed group, this genus passes into the next rather directly by means of S. macrothroides. The connection on the other hand seems to be by the way of Scapholeberis, though there is a rather broad separation between even Scapholeberis angulata and any known Simocephalus. The en-

The fact is, that the principle laid down by the Deacon (of venerable memory) that "the weakest pint must stand the strain," maintains in nature aside from the nature of "shays." The minutest forms are in some sense the most important, for they are the links which stand nearest the rock, and if they be loosened the dependent series falls.

The animals of the above group are, it is likely, the best criteria by which to judge of the purity of natural waters if their distribution were correctly understood. The presence of some species in great numbers is sufficient evidence of organic impurity. A critical study of the contents of samples of such waters will enable us to determine their character almost as well as by analysis. The following list of the animal life visible in a quart of filthy pond-water, taken by simple dipping, will perhaps be suggestive on this point:

Daphnia pulex	6
Ceriodaphnia	1400
Simocephalus	56
Cypris	50
Cyclops	30
Sand-fleas	120
Total Crustacea	1662
Infusoria	35
Arachnida (*Hydrachna*)	1
Vermes	5
Insecta—	
Coleoptera (larvæ)	8
Diptera (larvæ)	11
Hemiptera	10
Mollusca	35
Total	1767

The above are simply the animal forms visible to the (trained) unassisted eye; the truly microscopic forms number vastly more.

But each gathering includes specimens of carnivorous entomostraca as well, and these are not less interesting and bizarre than the cladocera.

The common cyclops, busy picking the bones of a luckless polliwog (must we say purwiggy?), is not less benevolent than the animate filters mentioned above. The amount of such material that they will dispose of in a short period of time is truly astonishing. It is the province of the following chapters to describe briefly such of these animals as fall in the two groups Cladocera and Copepoda and have been noticed in America.

"We have discussed the relation of the minute fresh-water crustacea to sanitary science in a paragraph in a recent article in the Naturalist, but it remains to touch upon another phase of the subject. It may be thought unnecessary to trouble ourselves about the pathological conditions prevailing among such lowly animals, but it can be shown that these same causes of disease may not be unimportant in connection with human diseases.

It is a fact constantly receiving new exemplification, that the parasites infesting small animals, particularly water animals, are frequently but the immature forms of parasites of animals higher in the scale. These alternating generations are exceedingly difficult to study, so that while all stages may be separately known, only a fortunate combination of circumstances or patient accumulation of facts can connect the individual factors into the complete cyclus.

Thus, for example, Prof. Leuckart has but recently worked out the full life-history of *Distomum hepaticum*, although the adult has been a stock example in helminthological study in the laboratory for years.

The importance of such parasites, even in a commercial view, needs but a reference to trichinosis to illustrate. I am not aware that endo-parasites are known in entomostraca except in the case of cyclops. Embryos of *Cucullanus elegans*, a nematoid worm, enter the body cavity of cyclops and undergo two moults and then are transferred to the intestinal canal of food fishes.[1]

A similar parasite of cyclops is *Filaria medinensis*.[2]

The cladocera are generally quite free from parasites, but I have found in several instances young nematoids in the blood sinus in front of the heart in *Daphnia schœfferi*. These worms subsist upon the nutriment in the blood which constantly bathes the animal. True cysts could not be formed in the cobweb-like tissues of the hosts. This is, so far as I can learn, the first publication of entozoa from cladocera, and the parasites are figured in Plate T, Fig. 15. The animals were from 'Schimels Teich,' Leipzig.

While collecting copepods near Tuscaloosa, Ala., I gathered a number of specimens of *Cyclops tenuicornis*, and nearly all were unusually pale and feeble. On examination they proved to be infested with a worm of the sub-order Distomeæ. This sub-order includes many distressing parasites and forms which are adapted to be widely distributed by a long period of adolescence, and the number of stages passed through before maturity is attained."

"The larvæ live frequently in mollusca, and in maturity inhabit the intostine of vertebrates.

Upon examination, the cyclops individuals collected were nearly distance. The terminal claws of the post-abdomen are straightish and are more heavily spined than in the preceding; the anal spines are doubly curved or geniculate. The pigment fleck is rhomboid or pentagonal; the antennules are smooth. The abdominal processes differ somewhat from the previous species, in which the second one is rounded above, for in this it is squarely truncate. This species was found only in shallow pools at Ocean Springs, Mississippi, and was very carefully compared with S. americanus which is also found there.

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[1] Claus. Kleines Lehrbuch d. Zoologie, p. 368.
[2] Fedschenko. Ueber d. Bau. u. d. Entwicklung d. *Filaria medinensis*, Moscow.

Sp. 5. **Simocephalus exspinosus,** Koch.

Head extending into an obtuse angle at the eye, pigment fleck rhomboidal. Shell without a spine; maximum hight of the shell greater than that of the free posterior margin. Caudal claws with an unequal series of spines; anal spines evenly curved. There is little to distinguish the above from this species save the geniculate anal spines and the presence of a blunt spine on the shell.

Var. **congener,** Schoedler,

has the lower outline of the head sinuate instead of angled.

Sp. 6. **Simocephalus daphnoides,** Herrick.

American Naturalist, 1883.

A curious transition form, found only south of the Tennessee river, was described in the American Naturalist in May, 1883, under this name. By an oversight a comparison made with S. americanus appeared as though made with S. vetulus. The general shape is oval; the greatest hight of the valves lies near the middle and not posterior to it as in all the other species. The head is short, depressed, rounded in front; the beak is wanting; the lower margin of the head is straight. The pigment fleck is small, oval or irregular: the fornices are small and short. The antennules are smooth.

The post-abdomen is narrow, shaped more as in Daphnia; the terminal claws are straightish and fringed part way with spines; the anal spines are slightly curved. The processes of the abdomen are long, as in Daphnia. The shell is covered by the characteristic striations and extends into a blunt spine. In every detail, almost, there is an approach toward the genius Daphnia, while the general result is sufficiently like Simocephalus. The lower angle of the shell is not armed with the peculiar curved spines as in all the other

The form is more slender than in C. plumicornis. The tracheal vessels are of a different form and color, and the viscera have obvious differences. Most conspicuous variations, however, are seen in the shape of the head, which is slender and attenuated toward the insertion of the antennæ. The antennæ are shortish and have a spine outwardly. The cuticular appendages have an unusual form as has the labrum. The anterior part of the head is spiny. The armature of the end of the abdomen is peculiar.

The posterior rudimentary appendages are of a different form, and the claws are replaced by club-shaped bodies. A curious appendage below is indicated in the name. The pupa has an extraordinarily elongate abdomen which terminates in two paddle-like appendages loosely ciliated outwardly. This species may be called

Corethra appendiculata, sp. n.

A NEW ECTOPARASITIC PROTOZOAN.

(Plate V. Figs. 12-13.)

The very strange monocellular animal referred to was found scurrying over the body of Diaptomus pallidus in a manner like that of a louse scrambling over a bare spot upon its host. The body is disc-shaped and about .04 mm. in diameter. The lower or ciliated side is flat and circular. The upper or aboral portion is convex with an annular depression of greater or less regularity about half way from the center to the margin. The lower side has a chitinous barred ring, corresponding to the depression above, containing about 25 radially arranged bars, each of which, apparently, forms the support for a long cilium which with the others forms a circlet extending beyond the margin. These cilia are used as feet and by them the animal is able to move in any direction, apparently with none of the uncertainty of motion usual to ciliate infusoria. The protoplasm is granular and contains one or more contractile vesicles, one of which appeared very regularly in the center of the chitinous ring before mentioned. These animals can also swim freely, but after a short excursion usually came quickly back, and after shuffling or sliding over the smooth surface of the crustacean assumed a position of repose. The generic affinites of this protozoan ies of Cyclops, and has since then been observed in mini

CHAPTER II.

ORDER CLADOCERA.

This very extensive group contains a variety of types, but there are sufficiently evident connecting links uniting the extremes of structure. The Gymnomera which, following the usual custom, we include here, stand distinct from the other groups, yet have sufficiently evident cladoceran affinities. It is very unfortunate for ætiological speculation that this the only truly marine group should stand thus isolated from its fellows. According to the notions at present prevailing, the Phyllopods stand nearest the primitive type of crustacea. There are unmistakable hints at an early origin for that group, and not less evident are certain analogies with both Cladocera and Copepoda.

There has, however, recently been made an attempt to derive the Phyllopods from an original cladoceran stem with, as we think, somewhat unsatisfactory results. Do we not the rather see in both groups two like phases which may be looked upon as incidental and comparatively trivial. The shelled and the shell-less phasis appears in both. The most closely shelled Phyllopod is unmistakably nearer Branchipus even than any of the Cladocera. It would seem that the brief and imperfect embryonic nauplius condition of the latter sufficiently indicated their later origin. Again no fanciful analogy can unite the Ostracoda with the Lynceidæ. We know of no recent discoveries casting discredit on the remark of Balfour: "the independent origin of the Ostracoda from the main crustacean stem seems probable."

Prof. Packard says:[1]

"We imagine that when a permanent body of fresh water became established, as, for example, in perhaps early Silurian times, the marine forms carried into it in the egg-condition, possibly by birds

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[1] "A Monograph of the Phyllopod Crustacea," etc., *XIIth Annual Rep. U. S. Geol. and Geog. Surv. Terr.*

[sic?] or by high winds, hatched young, which under favorable conditions, changed into Sida, Moina, and Daphnia-like forms. The Cladocera are, then, probably the more generalized forms, from which the Phyllopods, at this time and probably ever since Devonian times, *par excellence* a fresh-water assemblage of forms, took their origin." Whatever affinity there may be between the shelled Phyllopods and the Cladocera, it would seem that the evidence is conclusive that the latter group is not the direct continuation of the line of development inaugurated by an ostracode ancestor. As shown beyond, the present centre of the group seems near Moina with indications of a divergence from this rather generalized type, especially of degradation and heteronomy on the side of the Lynceids.

It seems at the present time that more might be accomplished for ætiology by a careful study of such groups as the present, in which are a variety of closely allied forms than by the attempt to join widely separated groups. When we shall have siezed upon the latest eddies and mapped their direction, it may become possible to combine the indications in such a way that lines of divergence thus traced accurately through some small part of their course may be produced backward to their intersection. This then is our present duty—the accurate mapping of minute districts and the careful noting of any moving straws, competent to indicate movements in the vast complex of vitalized nature. We conceive the cladocera to have had a comparatively recent origin, and to express the culmination and retrograde development of a plan of structure first differentiated after the appearance of clear bodies of fresh water. All the species save a very few are confined to inland waters. Accepting the above mentioned theory, the Sididæ will occupy the first place as departing least from the type from which the whole group sprang, while it is connected by the genus Daphnella with the Daphnidæ. The Daphnidæ, beginning with Moina, find their ultimate development in some monstrous forms of the genus Daphnia, but pass into the Lyncodaphnidæ by way of Macrothrix. The links uniting all these minor groups are very obvious.

Our own ideas of the relationships among the Calytomerous Cladocera are expressed in the accompanying table. This table is to be considered a projection of a portion of a genealogical tree, seen from below, in which the genus Moina forms the arbitrarily chosen fixed point. The heavy dotted line is imagined as directed downward vertically. That branch rising toward the top of the page is growing obliquely upward. The Daphnidæ are represented as expanding upon the same plane as Moina, and the Lyncodaphnidæ extend diagonally downward, producing the Lynceid branch The Bosminidæ spring from the stem at a lower point. These relations are made obvious by the figure giving a view of the ideal tree as seen from the side.*

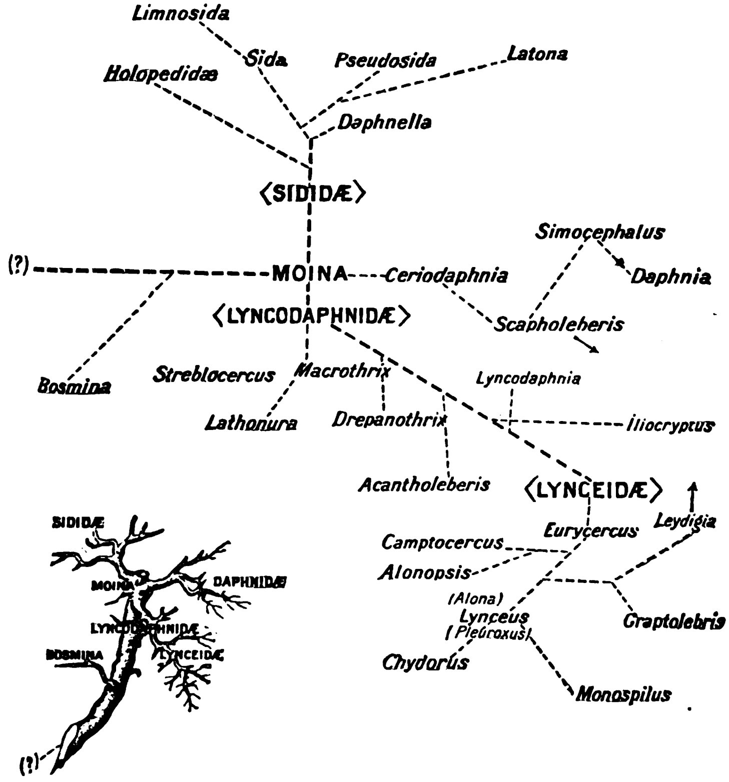

FIG. 1.—TABLE ILLUSTRATING THE RELATIONS OF THE

CLADOCERA CALYPTOMERA.

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*NOTE.—To adapt the diagram to the theory that the Lynceidæ are the progenitors of Cladocera, it is only necessary to revolve the imaginary line to the right, till it coincides with the axis of that family. The question mark may be understood to indicate that the source of the pivotal group, Moina, is uncertain. The author must confess that his inclination is toward a belief that the line culminating in the Daphnidæ diverged from a group of organisms resembling Phyllopoda, more definitely, resembling Limnetes. There is a very remarkable resemblance between the larva of Limnetes and Bosmina. The lateral spines of the former are, as will be shown true homologues of the antennules of Bosmina. The later origin of the Phyllopoda in their present form may be well admitted.

[1] Entomostraca, seu Insecta testacea, quæ in aquis Daniæ et Norwegiæ reperit descripsit, etc. *Otho Friedric Mueller*, 1785.

[2] Monoc. qui se trouvent aux Envir. de Geneve.

jaws, which latter are the larger in the embryo, being exceedingly large nerves.

This key contains the majority of the genus, but falls short of completeness. The following species are uncertain. W. Schmankewitsch described as new *D. degenerata* and *D. rudis*, from salt or brackish waters. These he regards as degenerate forms produced by the inferior aeration of dense waters. The author does not appear to recognize the modern distinctions of genera so that, not having seen the work, even the generic position can not be definitely stated. His investigations seem to show that the proximity of salt waters influence the form of the body, or, perhaps, that there is a constant interchange between the sub-marine and freshwater species. *Daphnia brevicauda*, Chambers, is an incorrectly figured and described Simocephalus.

KEY TO THE GENUS DAPHNIA.

Section I. Pigment fleck present.

A. Head short, equally rounded.
  1. *D. psittacea*, Baird.
B. Head not regularly rounded, more or less beaked.
  (a) Claws spiny.
    I. Abdomen broad, series of anal spines nearly equal, neither head nor back keeled.
    † A marked sinuosity in the posterior outline of post-abdomen.
    2. *D. schæfferi*, Baird.
      D. ovata, Sars.
      D. pennata, Mueller.
    †† No well marked depression.
    3. *D. pulex*, Mueller.
    4. *D. schœdleri*, Sars.
      D. hastata, Sars.
      D. obtusa, Kurz.
    II. Abdomen narrow, shell keeled somewhat dorsally.
    5. *D. minnehaha*, sp. n.
    6. *D. carinata*, Sars.
  (b) Claws nearly or quite smooth.
    I. Head not crested.
    7. *D. longispina*, Leydig.
    8. *D. rosea*, Sars.
    9. *D. similis*, Claus
      D. lacustris, Sars.
      D. cavifrons, Sars.
    10. *D. hyalina*. Leydig.
    11. *D. dubia*, Herrick.

D. pellucida, P. E. Mueller.
D. galeata, Sars.
12. (?) *D. lævis*, Birge.

Section II. Pigment fleck absent.

A. Head but slightly crested.
1. *D. longiremis*, Sars.
B. Head strongly crested.
2. *D. cristata*, Sars.
3. *D. cucullata*, Sars.
D. apicata, Kurz.
4. *D. kalbergensis*, Schoedler.
D. cederstromii, Schoedler.
D. retrocurva, Forbes.
D. vitrea, Kurz.
5. *D. magniceps*, sp. n.

SECTION I.

A. *Head short, evenly curved.*

Sp. 1. **Daphnia psittacea,** Baird.

Mentioned by SCHOEDLER, FRIC and KURZ.

This species is at once recognized by the head, which is very short and evenly curved, or nearly so, from the heart to the beak. The shell is high, oval, with a rather short spine. The fornices are wide and angled behind: the antennules are longer than in most species; the post-abdomen is very large, but narrows toward the end and has comparatively few anal teeth, which are of unequal size. This is one of the largest of the genus. Not yet found in America.

B. *Head more or less concave below, at least not evenly arched.*

Sp. 2. **Daphnia schæfferi,** Baird.

(Plate M. Figs. 1—4.)

Daphnia pennata, MUELLER.
Daphnia pulex, STRAUS, KOCH, (fide P. E. MUELLER.)
Daphnia magna, LILLJEBORG, LEYDIG, etc.
Daphnia schæfferi, SCHOEDLER, KURZ.

The largest species of the genus, is of an elongated oval and ventricose form. The spine is entirely absent in old females and of only moderate length in the young. The antennules of the male are long and have a very long flagellum. The post-abdomen is narrowed suddenly below the anus so that the spines consist of two sets; the terminal claws are spiny at the base. Although

"Antecedenti (D. pulex) simillima, caput autem a latere visum latius, rostro breviore, supra visum testa cetera parum angustius fere cordiforme, antice acuminatum. Processus anteriores duo disjuncti. Margo posterior postabdominis in medio sinulo parvo et infra hunc utrinque aculeis 16-18 armatus. Color ut in antecedente. Longit. $2\frac{1}{3}$ mm."

Daphnia ovata, Sars.

"Caput a latere visum ante oculum fere angulatum, margine inferiore leviter concavo in rostrum longum apicem versus attenuatum, extremitate tenuissima exeunte, spura visum ut in D. pennata cordiforme. Testa cetera a latere visa ovata, margine superiore et inferiore in femina adulta fere æquæs arcuatis, postice in medio spinam formans brevissimam vel omnino obsoletam. Processus anteriores duo abdominis disjuncti· Margo posterior postabdominis in medio sinuatus, utrinque aculeis 20-22 armatus. Color albido—flavescens vel-virescens. Longit. circit 3 mm."

Sp. 3. Daphnia pulex, Mueller

This commonest of our Daphnids is apparently circumpolar in distribution. I have found it in Alabama near the Gulf and it also occurs near lake Superior.

Oval, either elongate or short, spine springing from the upper angle of shell or in some cases near the middle. The spine is rather long in young individuals but becomes very narrow in older ones or entirely disappears. The abdominal processes are long, not coalescent, or slightly united at the base. The head is concave below and extends into a prominent beak. This species is either very variable or several species are frequently united under the term. Two types have been recognized in America. One, abundant in spring in smaller ponds in Minnesota, is rather short, arched above, and in old females with the spine situated near the middle of the posterior margin. This form is quite typical for the species and occurs from April to mid-summer. Another variety was found in Alabama in late autumn, and similar animals in mid-winter in lake Calhoun, Minnesota. This type has a much more elongate body, the very slender but rather short spine springs from the upper margin of the shell or is quite wanting. This longer form has the beak slightly arched so as to resemble a "Roman nose." The anal spines are less numerous (10-14 while typical D. pulex has nearly 20). The young of this form, which may be called

Daphnia pulex, var. nasutus, (Var. n.)

(Plate N. Figs. 1-4.)

vary much among themselves but, in general, resemble the young of the European form.

Daphnia pulex has been mentioned by a number of authors in America, Smith, Birge, Chambers and Herrick having noted its occurrence in various parts of the United States. *D. obtusa*, Kurz, is apparently only the spineless condition of the above or a related species. *No Daphnia* is without the spine through life; such a form would constitute a new genus at once.

Sp. 4. D. schoedleri, Sars.

Seems to resemble D. pulex very closely but differs in having the lower margin of the head nearly straight, terminating in a short straight beak. The spine springs from the middle of the posterior margin. The anal spines are 14-16 in number. Length 2.33 mm.

This name is applied by Sars to Schoedler's D. longispina which is not D. longispina of Leydig.

Sars' D. hastata is so insufficiently defined that it will probably be necessary to drop it from the list.

Sp. 5. Daphnia minnehaha, (Sp. n)

(Plate K, Figs. 1, 2; Plate L, Figs. 1, 2.)

This species, which occurs in small pools in autumn (affluents of Minnehaha creek, etc.,) closely corresponds apparently to Sars' Daphnia carinata but differs in numerous points. It, in fact, is more nearly related to D. pulex than the group under which that species is placed.

The form is oval, arched above, narrowed posteriosly, terminating in a rather short spine which curves lightly upwards. In males and young females the spine springs from the upper angle, but in old females having many summer eggs the spine is nearly median. The head is depressed, strongly arched and keeled slightly above the eye, which occupies the extreme end of the forehead. The keel of the head extends into a slight angle over the heart and continues down the back. In young females and in males the slight angle is replaced by a strong knife-like projection which extends into from 1 to 4 sharp teeth, the anterior tooth being directed forward. The males, in particular, have this feature emphasized. D. longispina has a somewhat similar projection but the more nearly related forms seem not to show this peculiarity. The beak is slightly curved and the lower margin of the head is slightly sinuate. The shell has the usual square reticulations and is usually very transparent but in peaty waters becomes brownish. The size is small but variable; 1.8 mm. is a common measurement. The post-abdomen is narrow, the claws are armed with four or more teeth and a series of lateral bristles. The anal spines are eleven or more in full grown females and decrease only moderately upward. The processes of the abdomen are distinct. The males are smaller and strongly carinated above and of the same form as young females The antennules are rather long, with a short lateral and a long terminal flagellum, which latter is more than twice the length of sensory setæ which are partially lateral. The first foot has a strong claw and a long flagellum, while the second feet have a small spiny hook. There is a single abdominal process which is not hairy as in D. pulex.

Sp. 6. **Daphnia carinata,** Sars.

Very similar to the last but, according to Sars, the claw has no well marked teeth, a short flagellum on the male antenna, and the abdominal processes are united at the base (which may indeed be sometimes the case in the above.)

D. cavifrons, Sars, has a prominence on the forehead and the lower margin of the head is strongly concave, otherwise hardly destinguishable save by the absence of the keel above.

Sp. 7. **Daphnia longispina,** Mueller.

D. longispina, O. F. MUELLER. BAIRD, LEYDIG, SARS, P. E. MUELLER, KURZ, WEISMANN, etc.

Oval, elongate; head large, rounded in front, lower margin somewhat concave; rostrum long. Spine very long, springing from the middle of the posterior margin. Post-abdomen attenuated toward the end. Terminal claws smooth or simply cilate, spines few. The abdominal processes are united at the base a very little. Flagellum of the male antennule hardly longer than the sensory setæ. The young have three teeth above as in D. minnehaha. There is a great deal of diversity of opinion as to the value of this name. Not that there is any doubt of the existence of a widely distributed form which in general is that intended by Leydig and others, but the variation is so great that the possibility remains that more than one species is included under the one title.

P. E. Mueller recognizes two varieties depending chiefly upon the length of the spine.

D. lacustris, Sars, is nearly related, if not a variety of the above.

Sp. 8. **Daphnia rosea,** Sars.

(Plate K. Figs, 10-12.)

In form very like D. longispina, this species, which is the only representative of this smooth-clawed, unkeeled group yet found in America, might perhaps be appropriately re-united with that species, but, as there seems little doubt of the identification with Sars' variety, as above, I prefer to use his name.

Body oval, moderately ventricose; head of moderate size, lower margin nearly straight; eye situated in the anterior prominence. The beak is not very prominent. The upper outline of the head is slightly concave above the eye or rather less convex. The head is separated from the body by a marked depression. The spine of the shell springs from the upper angle or is quite wanting. The post-abdomen is of moderate size, somewhat narrowed toward the end. The claws are smooth, the anal spines nearly equal, straight, about 14 in number. The abdominal processes are not coalesced or but slightly so. Length 1.50 mm. to 2.0 mm. The species was collected sparingly in a large gathering of D. pulex from a small lake in early spring.

The size and conformation of the abdominal processes is very variable and the long and very slender spine is frequently absent.

Sp. 9. **Daphnia similis,** Claus.

The description of this species, which was bred in confinement from eggs brought in mud from Jerusalem, I am, unfortunately, unable to quote. Judging however, from the figures which alone I now have access to, it belongs in the group of *D. longispina*, though in many particulars it resembles D. schæfferi. The form is elongate, the spine short and springing from the upper margin. The antennule of the female is very large and flagellate, while that of the male is like that of D. schæfferi. The flagellum and hook of the first foot of male are rather small.

We now come to a group of related species which are most difficult to circumscribe on account of their extreme variability. According to the view of Lutz they would all fall into the old D. hyalina of Leydig. More probably, however, some of these forms are of nearly or quite specific value.

Sp. 10. **Daphnia hyalina**, Leydig?

(Plate L, Figs. 3, 5.)

Daphnia longispina, HERRICK.

I have elsewhere given a brief account of the post-embryonic development of a species which agrees best with Leydig's figures of D. hyalina.

The lower outline of the head is nearly straight, the eye being always approximated toward it. In young specimens the head is sharp in front and crested. The lower margin of the head appears very long and the beak turns backward. The spine is very long in young forms but is short in old females. The male resembles very much the young female. The post-abdomen is narrowed toward the end, the terminal claws are smooth, the anal teeth few and the abdominal processes united. Our specimens are from Paducah, Ky., south of the Ohio river.

I do not know how to distinguish *D. lævis*, Birge, from D. hyalina, save that the abdominal processes are said to be distinct. Both forms were observed in the above mentioned gathering. If, however, Birge's figures are characteristic, he had a different variety before him from ours; it seems somewhat like D. galeata.

D. pellucida, P. E. Mueller, differs from D. hyalina in the presence of a series of small teeth on the caudal claws, and a more strongly curved beak.

It is just now brought to my attention that P. E. Mueller, in a late work, identifies D. pellucida with D. hyalina, though he still holds D. galeata distinct.

Daphnia galeata, Sars.

(Plate T. Figs. 7, 8.)

According to P. E. Mueller, this species differs from D. pellucida in the absence of teeth on the caudal claw, and, in one variety, by the acuminate head, which seems the only form for which the name is distinctive. Kurz found only the var. frons rotundata. According to Forbes, both varieties, the first of which he identifies with

S. I. Smith finds both in lake Superior, and seems to have no doubt of their distinctness. One of the forms which I have seen differs a little from either of the above, and had a different habitat. Kurz has described the male, which has a very short flagellum upon the antennule. A single source for D. galeata was found in a small pool known as Clarke's lake. This is the more remarkable, as this species, which is almost confined to larger bodies of water, is found nowhere else in the vicinage of Minneapolis, while this minute lake, though as deep, perhaps, as any of the largest in the county (say 40 feet), contains a number of forms known otherwise only in the Great Lakes. Kurz's remarks on the specimens collected by him apply equally to these. Were the claws dentate, the animal would pass as D. pellucida. The young have no horn on the head. The spine of the shell is nearly as long as the whole animal in the young. The male of our form is 1.2 mm. long, excluding the spine which measures 47 mm. The flagellum is a very little longer than the sensory setæ, and there is a very minute lateral flagellum. A peculiarity of this species is the scattered thorny armature of the spine of the shell. There is but little change in the form of head with age. The form of the last feet is peculiar. The ephippium occupies comparatively a small part of the valves and the spine becomes very short and quite smooth. The sexual period occurs in September and October.

The above statements regarding D. galeata require a modification, for in another deep lake the writer has since secured the typical crested D. galeata with even a higher crest than that figured by P. E. Mueller. The head ends in a sharp angle. The single female seen was in company with the rounded variety and numbers of D. kalbergensis, which it resembles in many respects. Our fauna therefore is quite complete in these remarkable forms.

(See Plate U. Fig. 6.)

Sp. 11. **Daphnia dubia,** Herrick.

(Plate L. Figs. 7, 8.)

American Naturalist, 1883.

The life history of this form is insufficiently known, but there seems no reason for doubting that it constitutes a new and easily recognizable species. It is nearly related to D. hyalina, but the head is strongly crested all round and the eye is withdrawn, in young as well as old specimens, toward the middle of the head. This peculiarity is shared in this degree by no other Daphnia

The form is as in D. pellucida, but the spine is more slender and directed upward. The head is shaped much as in D. vitrea in the young, but is much less prominent. The older form has a shorter and more slender spine (none were seen in the ultimate or spineless stage). The head is more evenly rounded, but still well crested. The abdomen is very slender and the anal teeth diminish rapidly in size from below upward. The claws are very short and armed down the whole length with fine bristles. The abdominal processes are well united at the base in old specimens, so that the second seems a small process of the first. The shell is very transparent and the spine is longer than in any other Daphnid. In a young specimen the spine was 1. mm., the body 0.7 mm., and the head 0.4 mm. In this specimen the spine was slightly curved, the head elongate with a slight ridge in front. Another individual had the spine 1.1 mm. long, while the remainder of the animal was 1,3 mm. This specimen also had a knife-like hyaline ridge on the crest, which was obliquely truncate in front; it also had numerous summer embryos in the brood sac. The spine was perfectly straight and but slightly inclined upward. Older individuals have a rounded crest as figured and no ridge. The spine is relatively somewhat shorter but much more slender. The characters which most clearly distinguish this species are the well crested head, which in young as well as sometimes older specimens has a median hyaline ridge, the withdrawal of the eye from the margin and the very long spine. It resembles D. galeata in earlier stages. It is very much like D. lævis or, in other words, is in the group of D. hyalina; but the study of a considerable number of specimens from different localities convinces me that it can not be united with that species in any of its varieties. This species has only been found in autumn, Sept.—Nov., lake St. Croix and Richfield in Hennepin county.

SECTION II.

Pigment fleck wanting. Head crested. The small, hyaline species constituting this section, elevated by Schœdler to the rank of a genus (Hyalodaphnia) and by Sars to that of a subgenus (Cephaloxus), are chiefly residents of the deeper parts of our larger lakes. These forms, from their rarity, have been little studied and it is uncertain how far the assumed specific distinctions are valid.

Two species are known in America and they are not confined to large lakes.

Sp. 1. **Daphnia longiremis**, Sars.

Hyaline, compressed, seen from the side, rounded, lower margin strongly arched; spine long, straight, oblique. Head rounded, lower margin nearly straight, ending in a beak directed downward, acute anteriorly. Eye small. Antennæ very long. Length 1 mm.

The abdomen is said to be similar to that of D. longispina. From the brief description given by Sars it would appear that this species is characterized by a rounded and uncrested or slightly crested head. Though imperfectly described, it is here mentioned to direct attention toward any such species as may be found in America.

Sp. 2. **Daphnia cristata**, Sars.

Compressed, long. Head acute in front, strongly crested, lower margin nearly straight. Dorsal line of body little curved, spine long in the young, strongly curved. Head of male smaller, flagellum of antennule twice as long as the setæ; first foot well clawed. Length of female 1.33 mm.

Sp. 3. **Daphnia cucullata**, Sars.

D. berolinensis, SCHOEDLER.

Very like the above, but the margin of head is not straight below, is, however, extremely variable and ends in a sharp angle. The eye lies nearly midway between the heart and the end of the head and near the lower margin. The two anterior processes of the abdomen are united for most of their length. The flagellum of the male antenna is about as long as the terminal setæ.

D. apicata, Kurz, seems to be a large variety lacking the sharp spine of the head. In the main it agrees quite well. Although the post-abdomen is broader than figured by Mueller, the number of teeth corresponds with Sars' description.

Sp. 4. **Daphnia kalbergensis**, Schoedler.

(Plate U. Figs. 1—3).

Form oval, spine long. Head high, compressed, enormously elongated, beak obtuse. Eye small. Abdominal processes not united. Caudal claws ornamented with small setæ. Antennæ of male with a short flagellum. Length of head nearly equal to that of body exclusive of spine.

D. vitrea **of** Kurz seems not improbably a varietal form of the **above though the** crest is lower, the size is less and the post-abdo-

The claws of the post-abdomen have, besides the row of fine teeth mentioned by Mueller, a cluster of sharp teeth just at the base.

Found, together with typical D. galeata and the rounded form, in a small deep lake or expansion of a creek not far from Medicine lake, Hennepin county, Minn.

Sp. 5. Daphnia magniceps, (Sp. n.)

(Plate U. Fig. 15).

The peculiar form figured in the Tenth annual of this survey seems indubitably new and is distinguished by the peculiar shovel-shaped head, which is scarcely crested but is broadest beyond the middle. The spine is long, the claws smooth, the abdominal processes united and the shell transparent. The eye is near the end of the rounded head and is large; the pigment fleck was apparently absent. Found with Daphnia minnehaha in a shallow swampy pool in autumn.

FAMILY BOSMINIDÆ.

The sole genus of the family, Bosmina, contains over a dozen nominal species which are among the most difficult to define of any cladocerans. The number is here reduced to nine and the probable position of the rejected species is indicated. This is not done because the author presumes upon the slender material at hand to revise the genus; but simply from the fact that the descriptions of the earlier writers do not permit a proper discrimination; so that this necessity is entailed upon any one who would give a birds-eye view of the members of the genus. The B. diaphana is founded upon a different twist in the antennules and no hesitancy is felt in uniting it with Sars' B. lilljeborgii. The other species, B. brevirostris and B. nitida, are omitted simply because there seems to be no way of separating them satisfactorily from B. maritima and B. obtusirostris respectively. Three species have been found in Minnesota, but practically no attention has been given to the genus here.

Bosmina macrorhyncha found in Egypt is not here included, its description being inaccessible to me.

B. lævis, Leydig, seems simply a smooth condition of other species. Whether B. curvirostris, Leydig, is or is not valid must, so far as I am concerned, remain at present doubtful.

GENUS BOSMINA.

A. Shell extending into a spine behind.

(a) Antennæ curved outward.

1. ***Bosmina cornuta***, Jurine.

(b) Antennæ not curved outward,

  I. Shell reticulated, at least in part.

  † **Flagellum midway between** eye and the sensory setæ **of antennæ.**

  2. ***Bosmina longirostris***, Mueller.

  †† **Flagellum nearer eye.**

  3. ***Bosmina maritima***, P. E. Mueller.

  4. ***Bosmina longispina***, Leydig. (B. brevirostris?)

  II. Shell striate.

  † **Antennules long.**

Concerning the identification of Bosmina longispina, Leydig, with B. brevirostris, P. E. Mueller, it must be said that the bow is drawn at a venture, for Mueller, in his paper on the Cladocera of Swiss Lakes, in a fit of absent-mindedness refers to B. lacustris, P. E. Mueller, citing p. 149 of Danmark's Cladocera. On the page in question are descriptions of B. maritima and B. brevirostris of which the latter is probably the one meant. Sars' B. lacustris seems quite different, being strongly marked by longitudinal lines, while Leydig says of B. longispina "shell striped and small reticulate," and P. E. Mueller says in B. brevirostris the shell is "utydeligt reticuleret" i. e. indistinctly reticulate.

The three species so far identified in America are B. longirostris, of which a figure is given (plate J, fig. 2,) B. cornuta and B. striata, which may possibly be yet identified with one of the European species, though it seems improbable. I have also seen a species like Leydig's B. lævis, but considered it a smooth variety of B. longirostris.

FAMILY LYNCODAPHNIDÆ, Sars, 1861; Herrick, 1881.

This is a rather small family with seven genera of minute animals which are abundant only in summer. Many and, indeed, most of the species are among the rarer of fresh-water crustaceans of this group, and a few are among the rarities which only now and then reward the collector. This family undoubtedly is the link connecting the Daphnidæ with the Lynceidæ, relationships to which are expressed by Macrothrix, on the one hand, and Lyncodaphnia, on the other.

The rank of this group as a family must be, of course, a matter largely of opinion. Sars was the first to adopt this view, sustained by certain curious transition forms leading toward Lynceidæ. Later writers seem never to have found these genera and the group was again included with the Daphnidæ. The writer, upon the discovery of the Lyncodaphnia, was forced to regard this group as of equivalent grade with the above mentioned families and again proposed the family name Lyncodaphnidæ.[1]

The genus Ilyocryptus is a little one side the normal course of the family and seems related to the lynceid genus Leydigia.

The waters of the northern United States are very rich in members of this family.

The aberrant family Bosminidæ finds its only connection with other Cladocera through this group by means of the remarkable Macrothrix (?) pauper; and here it is only vaguely hinted at in the elongated antennules and angled lower margin of shell, as well as the presence of certain bodies near the base of the antennules. It has been affirmed that none of the Lyncodaphnidæ have an ephippium, i. e. the saddle-shaped thickening of the shell walls to include and protect the winter eggs; but I have discovered it in the case of Macrothrix tenuicornis, Kurz, and presume it may occur exceptionally in others. Kurz says that Ilyocryptus has no moult proper, but this probably refers only to the European I. sordidus. The American species differs from the generic description given by Kurz, and may be different in this respect also.

In this family the regularity in the disposition of the setæ on the antennæ is broken and the fringing of these hairs serves the purpose of specific distinction. The antennules are always long and frequently differ considerably in the sexes. The pigment fleck is always present (Kurz is in error in denying its existence in Lathonura). In many forms there is no free posterior margin of the valves, while the lower is generally thickly beset with movable spines. The Lyncodaphnidæ will be distinguished from Ceriodaphnia, which they resemble, by their motion, which is a succession of quick bounds, while the broader Ceriodaphniæ hobble along as though heavily weighted by the enormous mass of eggs with which they are generally laden. The abdomen is usually short and the anus is behind the terminal claws, but in Ilyocryptus the claws are long and spined at the base. In the American I. spinifer the anal opening is elevated to a point nearly underneath the stylets, and there is a rudimentary anal cæcum as in Lynceids.

The males have the opening of the vasa deterentia in front of the claws, which may be absent; the antennules are also modified, being longer and curved. In Lathonura the abdomen is elongated posteriorly till it begins to suggest a transition to Polyphemus. The known genera and their distribution is as indicated below.

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[1] Notes on some Minnesota Cladocera. 1881.

Half of the known species are found in America; one sixth being peculiar to it.

GENERA.	Total number of species.	Europ-ean.	Also Amer-ican.	Only in America	Total Amer-ican.
1. Macrothrix	4	3	2	1	3
2. Lathonura	1	1	1	......	1
3. Drepanothrix	1	1	......	......	......
4. Streblocercus	1	1	......	......	......
5. Acantholeberis	1	1	......	......	......
6. Ofryoxus	1	1	1	......	1
7. Lyncodaphnia ?	1	......	......	1	1
8. Ilyocryptus	3	2	......	1	1
Totals	13	10	4	3	7

I. GENUS MACROTHRIX, Baird.

Body oval, pointed behind; head broad; antennæ of first pair long, nearly straight, beset with spines, olfactory threads terminal; swimming antennæ large and powerful, propelling the animal by bounds; three-jointed ramus with a greatly elongated seta which is thorned and jointed; labrum with the basal joint enlarged, resembling that of Lynceids; first foot with a hook in both sexes; last foot with a long process (respiratory body); abdomen short; claws short; caudal stylets often with a bush of hairs at tip. The intestine is straight and without cæca in front or behind.

The first one to observe a member of this genus, apparently, was O. F. Mueller whose Daphnia curvirostris is usually referred to Macrothrix laticornis.

The name Echinisca was proposed by Lievin, but Macrothrix was applied by Baird in 1843. Four species are known, three of which occur in America and without doubt the fourth will ultimately be found. No males of this genus were known till 1877 when the male of M. laticornis was described and figured.[1] Nearly two years later the male of M. rosea was described from Wisconsin by E. A. Birge. Descriptions of the male of Lathonura are also given in both the above mentioned sources.

Sp. 1. **Macrothrix laticornis**, Jurine.

(Plate C. Figs. 7, 8 and 9.)

Daphnia curvirostris(?), MUELLER.
Monoculus laticornis, JURINE.
Lynceus laticornis, DESMAREST.

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[1] Gruber und Weismann, Ueber einige neue oder unvollkommen gekannte Daph

Macrothrix laticornis, BAIRD, Ann. Mag. Nat. Hist.
Acanthocercus curvirostris (?), SCHOEDLER, Erichs. Archiv, 1846.
Daphnia curvirostris, FISCHER.
Macrothrix laticornis, LILLJEBORG, LEYDIG, BAIRD, P. E. MUELLER, FRIC, KURZ, SARS, LUTZ, CLAUS (Die Schalendruse d. Daphnien), NORMAN and BRADY (Monogr. Brit. Entom.), GRUBER and WEISMANN, WEISMANN, (Beitrage zur Naturgeschichte d. Daph.)

This is the commonest European species and is the type of the genus, showing its rather conservative position by the broad tip of the antenna which is a feature exhibited by embryos and young of other species. The shell has a warty surface and is toothed above, while the lower margins are fringed with long unequal spines in groups of threes or fours.

The form is roundish with a blunt posterior angle, the ventral margin being regularly curved. The antennules are short and enlarged at the end. The form is an irregular pentagon; a pair of slender spines sits at the angle near the base.

The swimming antennæ with the seta on the first joint of 3-jointed ramus very long. Post-abdomen truncate at the end, short, posterior margin beset with series of bristles.

Length of male 0.5—0.6 mm., of female 0.4 mm.

This is the smallest of the genus and will undoubtedly be found in America.

Sp. 2. Macrothrix rosea, Jurine.

(Plate C. Figs. 5, 6, 11, and 13.)

Monoculus roseus, JURINE.
Lynceus roseus, DESMAREST.
Daphnia rosea, M. EDWARDS, JURRELL.
Echinisca rosea, LIEVIN.
Macrothrix rosea, BAIRD, LILLJEBORG, P. E. MUELLER, BIRGE.

The body is sub-oval, terminating behind in an acute angle; the lower margin is less conspicuously spined than the last or the following; the antennæ are but slightly dilated at the end and nearly straight. The longest seta of the antennæ is longer than in the last, reaching beyond the tips of the terminal setæ; abdomen more slender, sinuate in front, beset with short hairs.

Length 0.6 mm, male 0.3 mm. The male has no claws on the end of the post-abdomen, and the antennules are curved and elongated. Figures 5 and 13 are copied from Birge.

(Plate C. Figs. 1, 1 a, 2,

era of Minnesota, p. 243.)

al, produced posteriorly in a sharp point; the ab-
y arched, while the upper outline of the head is a
slightly extended in front of the eye; the anten-
early straight and a very little narrowed toward
front of which is a series of short teeth; there is no
t a strong terminal one in addition to the sensory
igment spot is large, the eye small and the lobus
arated from the ganglion; the antennæ have a very
joint; the elongated seta is very stout and densely
tooth at its flexure; two of the terminal setæ are
basal half; the valves are beset with very long spines
e each, all having different positions; the abdomen is
I. rosea, but the posterior margin has a series of long
he mandibles are nearly completely exposed by the
ior margin of the valves.

m, in this species, is an odd link between that of the
nd Lynceidæ. The basal segment is greatly enlarged
riangular in outline, with a movable lip attached to the
ce; the typical daphnoid structure is preserved. but the
lient angle of the basal portion shows how the transi-
great triangular labrum of Alona, etc., is made. In
imens the head is proportionately larger, the antennules
r at the tip, and the dorsal outline is less convex; the
spines of the valves are also proportionally larger, as are
dages of the first and last pairs of feet. This is one of the
pecies of the genus, 0.75 mm. being the length. This
se to M. rosea but seems distinct.

rm is quite common about Minneapolis, Minn., but is not
l elsewhere in America.

Sp. 4. **Macrothrix pauper**, Herrick.

(Plate C. Fig. 4.)

species is described from a single specimen from L. Minne-
and I can add nothing to the very meager notice given

The body is broad and very narrow, the lower outline is angled and nearly unarmed; the pigment fleck and eye are small and approximated; antennules very long and curved backward and outward; abdomen short, ciliate below; claws short, ciliated. This female had a full complement of eggs but the antennæ resemble those of a male. This is unusually interesting and should be rediscovered and studied; for there seems to be some affinity between this species and Bosmina, and it is probable that it requires to be distinguished generically from Macrothrix.

II. GENUS LATHONURA, Lilljeborg.

The form is oval; the head is curved more than in Macrothrix and the shell is more obtuse behind, sinuate below where it is beset with short spines anteriorly; first antennæ long, straight; second antennæ with five setæ on each ramus; only four pairs of feet apparent; abdomen short, prolonged upward to the insertion of the caudal stylets; male similar but smaller.

Sp 1. Lathonura rectirostris, O. F. Mueller.

(Plate D.)

Daphnia rectirostris, O. F. MUELLER.
Pasithea rectirostris, KOCH, Deutschland's Krust., etc.
Daphnia brachyura, ZADDACH, Syn. Crust. prussicorum. LIEVIN, Die Branch. d. Danziger Gegend.
Daphnia mystacina, FISCHER, St. Petersb. Branchiop.
Lathonura rectirystris, LILLJEBORG, De Crust. ex ord. trib.
Pasithea rectrirostris, LEYDIG, Naturg. d. Daph.
Lathonura rectirostris, NORMAN and BRADY, Monogr. Brit. Ent.; P. E. MUELLER, Danmark's Cladocera.
Lathonura spinosa, SCHOEDLER, Branchiop. d. Umg. v. Berlin.
Pasithea rectirostris, GRUBER and WEISMANN, Ueber einige neue od. unvollk. gekannte Daph.
Lathonura rectirostris, BIRGE, Notes on Cladocera. HERRICK, Notes on Minnesota Cladocera.

The only species of the genus is distributed probably over the entire northern temperate zone. It has been found in America at Cambridge, Mass., and in the vicinity of Minneapolis, at both of which places it is very rare.

The form is a rather quadrangular oval, the head being strongly arched to the beak which is much farther posterior than in Macrothrix, in this respect resembling the Daphnidae; the eye occupies the center of the lower part of the head margin, and is of moderate size; the pigment fleck is near the base of the antennules and well removed from the eye; the antennæ are straight and long, with a sensory bristle near the base in front and two bristles a third from the end; the second antennæ are furnished with a powerful basal joint, while each of the main subdivisions of the rami has its bristle, which are nearly equal; two of the terminal setæ are toothed for the basal half and pectinate distally, but the others are feathered throughout; the four-jointed ramus has a spine on the second joint and a longer one at the end, and all the joints of both rami are ornamented with triple series of spines; the maxillæ are three-spined at the end and are in almost constant motion; the first pairs of feet have curious comb-like bunches on some of the setæ; the abdomen is very short and terminates in inconspicuous teeth, the posterior part of the abdomen being ornamented with teeth flattened longitudinally so as to look like spines from the side; the last foot is simple but bears a large appendage; the posterior third of the shell is fringed by extremely minute spines, but anteriorly by lanceolate stiff spines flattened longitudinally like the spines of the abdomen; the caudal setæ are seated on a high prominence of the abdomen, and are fringed along their whole length, not merely at the end. The female is 1 mm. long, the male 0.5—0.6 mm., in which sex the antennules have more numerous lateral bristles, the first foot has a claw and the back is less elevated. The semen bodies are irregularly round with small nuclei.

III. GENUS STREBLOCERCUS, Sars.

In form like Macrothrix laticornis, head terminating in a long rostrum bearing the long, twisted antennules. Antennules very large, curved backward and outward. Head not separated by a destinct depression from the body, very high, slightly arched above, abrubtly curved below with spines upon the margins. The antennæ are large; four-jointed ramus much the longer, with four setæ. Labrum with a large process. Post-abdomen as in Macrothrix laticornis. Eye near the beak ; pigment fleck small, below it at the base of the antennules. Length .33 mm. S. minutus is the only species.

Our Macrothrix pauper seems a near approach to this genus; both have a strong spine or claw on the first foot which projects beyond the shell, but there are many differences. M. pauper is 1 mm. long.

IV. GENUS DREPANOTHRIX, Sars.

The head not separated from the valves by a depression; fornices moderate; rostrum rather acute, distant from the anterior edge of the valves. The form is subrotund; reticulate, with the margins of shell fringed below by long movable spines; pigment fleck present; swimming antennæ with three ciliated setæ on the 4-jointed ramus, the 3-jointed ramus with its basal joint armed with an unjointed, strong, spinous seta and four ciliated setæ on the remaining joints. The post-abdomen is broad. The male has longer antennæ and a hook on the first foot.

Sp. 1. **Drepanothrix dentata**, Euren.

(Plate C. Fig. 14.)

Acantholeberis dentata, EUREN.
Drepanothrix setigera, SARS.
Drepanothrix hamata, SARS.

This animal is only 0.5 mm. in length. The antennules are laterally curved in the middle and ornamented with notches on the margins; the pigment fleck is quadrate and rather large; the post-abdomen is truncate at the end, convex behind and ornamented with a series of small spines. Only found in Scandinavia as yet.

V. GENUS ACANTHOLEBERIS, Lilljeborg.

Head separated by a depression from the body, with fornices above the base of the swimming antennæ; rostrum erect, rather acute; shell oblong, truncate behind, ciliate below with long setæ; macula present; antennules rather long, movable, sensory setæ terminal, bifid at the apex.

The tri-articulate ramus has a long spiny seta on the basal joint; feet six pairs; no abdominal process; post-abdomen wide, large; intestine without cæca.

Sp. 1. **Acantholeberis curvirostris**, Mueller.

Daphnia curvirostris, O. F. MUELLER.
Acanthocercus rigidus, SCHOEDLER. LIEVIN.
Acantholeberis curvirostris, LILLJEBORG, P. E. MUELLER.

This species of a genus approximating the Lynceids has not yet been found in America but is to be expected.

The abdomen is rounded toward the end and spiny posteriorly; the terminal claws are furnished with two strong teeth at the base, ies of fringing bristles. The length, according to m. This is a rare form in Europe.

VI. GENUS OFRYOXUS, Sars.

pecies constituting this genus seems to have been er save Sars. At the time my previous paper on published, Sars' description seemed not to apply to l Lyncodaphnia. Since then several stages in the ncodaphnia have been encountered, which so far agree said of Ofryoxus gracilis that it is doubted if the two identical.

VII. GENUS LYNCODAPHNIA, Herrick.

(Plate B. Figs. 12, 15; Plate B1, Figs. 1, 3.)

ngated, somewhat rectangular as seen from the side, dth and hight of shell a little posterior to the heart; rated by a depression from the body, truncate below; nd antennules much as in Macrothrix; 4-jointed ramus æ with no lateral setæ; eye small, pigment fleck present; twice convoluted, expanded posteriorly, with anterior but ior cæca, opening near the "heel" of the post-abdomen; men large, triangular; terminal claws long, rather straight, accessory spines at the base.

pecies upon which this genus was founded[1] occurs in and September in the larger lakes of Minnesota.

odaphnia is, as was suggested, a curious transition form the Daphnidæ with the Lynceidæ.

rther study of the genus shows that, in some respects, it is losely allied to both groups than before suspected. The habit ppearance in the water reminds us of Simocephalus, a re- ance which an occasional spot of pink or blue color hightens. macrothroides not only has the disc-like last foot colored but wimming antennæ are banded with purple as in Simocepha- stratus, Her., and S. americanus, Birge. The intestine has ior cæca, which is not the case in lynceids nor, indeed, in Lyncodaphnidæ.

e four-jointed ramus of the antennæ approaches Lynceidæ in bsence of a lateral seta, but the other ramus is as in Macro- The convolution of the intestine, the form of the post- nen and the situation of the anus, are all of a strictly lynceid type; moreover the flattened appendage of the last foot is like that of Eurycercus.

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[1] Minnesota Cladocera, p. 247.

Even in the form of the shell there is a combination of characters; the anterior part of the shell has the form peculiar to Lyncodaphnidæ; but posteriorly it again expands and becomes truncate behind; the form in the adult is not unlike that of some Lynceidæ, but the young has a long spine posteriorly exactly like the spine of Daphnia. The latter fact is very instructive, for it indicates that the theory proposed (Am. Naturalist, 1882, p. 815) to explain the origin of this appendage is probably the correct one. Professor Leuckart suggested that this spine was a balancing rod intended to keep the proper equipoise over the center of gravity; but it is difficult to see why these long-bodied forms, in which the greater part of the weight lies "abaft" of the pivotal point—the base of the antennæ—should be thus provided while the shorter forms are not. We conceive that it is an apparatus for effecting the moult of the inner lining of the brood cavity of long-bodied and tender-shelled animals such as Daphnia and the present genus. The great development of the head in the crested Daphnidæ may undoubtedly be explained upon Prof. Leuckart's theory.

Sp. 1. **Lyncodaphnia macrothroides,** Herrick.

(Perhaps = Ofryoxus gracilis, Sars.)

Notes on Cladocera of Minn., p. 247.

Sub-rectangular, greatly elongated, truncate behind, with a slight spine above; head and eye small, fornix moderate, beak truncate; antennules rather long, slightly curved, tapering a little toward the end, whence spring three lanceolate spines and several sensory filaments, five stout spines behind, above the middle, and several more slender ones; swimming antennæ very long, terminal setæ smooth to the joint; labrum as in Daphnia; mandible attached behind a salient angle of the front margin of the shell; no abdominal processes; post-abdomen broad above, triangular; terminal claws pectinate, furnished with one very large toothed accessory spine and a smaller one; the first foot has a hook; the last foot consists of a large oval plate which bears posteriorly the ordinary branchial coil, here shaped like a thumb and forefinger. The young is of a different shape and bears a long spine. The male is unknown.

igher than long; head small, terminating anteriorly in
right angle; posterior part of the shell margins covered
nching, thorny spines; antennules cylindrical; antennae
ur-jointed rami with no lateral setæ; post-abdomen large,
rminal claws with two spines at the base; anus in the
f the posterior margin, which is very heavily armed with
hairy abdominal process is present according to Kurz.

are no anterior cæca (my statement that P. E. Mueller
such cæca was an error; see Notes on Cladocera of Minn.,

Sp. 2. Ilyocryptus spinifer, Herrick.

(Plate C. Figs. 18—19.)

Usually longer than high; head rounded, almost exactly like I. sordidus, but the form of the post-abdomen differs a little in the higher situation of the anus and the great elongation of four or five of the lower spines of the posterior margins; the margins of the shell are beset with pectinate setæ which do not branch. The nearest approach to branching setæ yet seen are figured on plate C, fig. 18a; this consists in the outgrowth of a spine from near the base, and such setæ are found only on part of the posterior margin.

It seems that our form is rather close to I. sordidus though clearly distinct.

This species occurs in many of our lakes, and is found most frequent in late summer.

Sp. 3. Ilyocryptus acutifrons, Sars.

This species is only mentioned in the appendix to the paper of Sars on the Cladocera from the vicinity of Christiania. The following is a condensation of the description.

Head large, acute in front. Shell truncate behind, with shorter setæ behind than below. Antennules shorter and thicker than in I. sordidus. Antennæ long and robust. Abdomen with a short, obtuse process. Post-abdomen shorter than in I. sordidus, posterior margin continuous, anus terminal; caudal claws straight, very long, with two minute basal spines. Pigment fleck almost touching the eye. Length less than in I. sordidus.

This species seems in some respects more like a true lyncodaphnid than either of the other species. It is doubtful if it belongs here.

FAMILY LYNCEIDÆ.

GENERA.	Number of known species.	European.	Also in America	In America only.	Total American.
1. **Eurycercus**	1	1	1	....	1
2. **Acroperus**	2	2	1	....	1
3. **Camptocercus**	6	5	1	1	2
4. **Alonopsis**	3	2	1	1	2
5. **Leydigia**	2	2	2	....	2
6. **Graptoleberis**	2	2	1	....	1
7. **Crepidocercus**	1	....	....	1	1
8. **Alona**	21	14	6	7	13
9. **Alonella**	5	5	2	....	2
10. **Pleuroxus**	14	8	1	6	7
11. **Harporhynchus**	1	1	....	....	....
2. **Chydorus**	8 (?)	6 (?)	3	....	3
13. **Anchistropus**	1	1	....	....	1 (?)
14. **Monospilus**	1	1	1	....	1
Totals	68	50	20	16	37

Out of the fourteen genera, two (or perhaps only one) are not yet known from America, while one is restricted to it. The American species, 45 per cent of which are new, aggregate 72 per cent of the European. 54 per cent of all the known species are American, and most of these have been found within a range of ten miles of Minneapolis. It is probable that the number of species peculiar to America is too high proportionately rather than the reverse, and the comparatively high per cent of new species is due to an actual larger fauna in the New World, while many Old World species remain to be identified. A few of the European species are very likely synonyms, permitting farther reduction.

This family, which is numerically the largest among the Cladocera, is, in the main, well limited, though there are transitions toward the Lyncodaphnidæ, which are quite direct. The genera Lyncodaphnia, Ofryoxus and Ilyocryptus lead toward the Lynceidæ unmistakably. Most of the members of this family are small, comparatively few exceeding one millimeter in length. The head is covered with an arched shield, which frequently passes with no indentation into the shell of the body. This head-covering generally extends forward and downward to form more or less of a sharp angle in front, while in several genera it is simply rounded in front. It, in either case, arches over the more fleshy lower side of the head from which hang the two short antennules and the labrum, while the strong two-branched antennæ spring from well up under its posterior expansion. The rounded sides of this shield, which protect the insertion of the antennæ, are called the fornices. Above the insertion of antennules is a dark fleck lying near or on the lower angle of the brain; this is the larval or nauplius eye, which is the first to appear in all these small crustacea. This *macula nigra* is not infrequently as large as the eye itself,* or even larger, and in one genus it is the only visual organ. The antennules are small and bear on the end several sensory filaments as well as a lateral flagellum. The antennules of the male differ very little from those of the female. The labrum is furnished with a process, which is triangular or semicircular and is usually larger than the terminal portion. The mandibles are as in Daphnidæ but usually shorter. Maxillæ are often conspicuous, but the first pair of feet serve, by a slight alteration at the base, the same purpose. There is rarely an indication of the sixth pair of feet, and the antennæ have both rami three-jointed. The terminal part of the body, or post-abdomen, is usually enlarged, and the anal opening is near its base; the armature is usually considerable. The form of the post-abdomen is one of the best criteria for distinguishing genera and species—a process often attended with much difficully.

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* The name "Lynceus" is derived from that of the son of Aphareus who was famous for the sharpness of his vision

The shell is of various forms, frequently beautifully sculptured. The number of eggs produced at one time is limited, and the winter eggs are very often laid in the brood-cavity with no preparation of the shell previous to it, in other words, the ephippium may be absent. On the other hand, sometimes the shell is considerably modified, and generally there is a deposit of dark pigment in the upper part of the shell. The males are very rare and until recently few were known. The diligence of Kurz has added a great many, and we now have a fair idea of the sexual variations. These consist usually in a narrower body and shorter beak, in a strong hook of chitin on the first foot and certain modifications of the post-abdomen. The hook mentioned is simply an enlargement of one of the terminal bristles of the foot, and serves to fasten the animal to the shell of the female. In one American species of Pleuroxus we find an approach to this structure in the female—an interesting example of inheritance of sexual peculiarities across the sexes. The alterations in the form of the post-abdomen consist in a narrowing or excavation of that organ to permit its introduction into the brood-cavity, and in some forms (Chydorus) this change can only be understood by observing the form of the shell of the female about to produce winter eggs. In general, as in other Cladocera, males are found only at the period when the females are sexually perfect. The ordinary method of reproduction is by virgin-bearing or parthenogenesis. In some cases it would seem from Weismann's observations that the sexual method occurs only incidentally. The orifice of the male organs is between, or anterior to, the terminal claws of the post-abdomen (Eurycercus alone excepted). The males are usually but not always smaller. Plate E gives views of typical Lynceidæ Fig. 1 is particularly instructive, for in it the details which can be usually made out in the living object are represented. The following points may be especially noticed. The large size of the pigment fleck, the large antennules (A^1), the keel of the labrum (Lb.), the peculiar modification of the first pair of feet to assist the maxillæ (not shown) which are exceedingly small, the largely developed anal gland (A. g.), the form and muscular mechanism of the abdomen, which, however, is better illustrated by fig. 10 of the same plate. Fig. 1 contains an embryo seen from the side with the partially developed limb. Fig. 3 shows the appearance of a different embryo from below and in an earlier stage. Fig. 2 illustrates the relation of the brain to the eye and the very small optic ganglion. Fig. 9 of plate G gives details of the feet in another species, and the modifications seen in the male of the same species are sufficiently shown in fig. 1 of the same plate, which also well illustrates the various sculpture of the shell displayed by this group. Figures 4 and 9 of plate F show curious modifications of the post-abdomen of the male, and fig. 7 exhibits the structural peculiarity of sexually perfect females which is correlated with it or, perhaps we may say, occasions it.

SUB-FAMILY I.—EURYCERCINÆ.

A single species constitutes the sub-family, and it will be necessary to point out only those points which are distinctive.

The Eurycercinæ differ from the true Lynceidæ and approach the Lyncodaphnidæ in having the digestive tract not coiled, with two cæca in front and the anus at the end of the post-abdomen. Many eggs are produced at once. The male opening is at the base of the abdomen, as in Sididæ. The general habitus is, however, lynceid. The males appear in autumn or when, by the gradual drying up of the water or other causes, the continued existence of the animals is threatened.

I. Genus Eurycercus, Baird.

Characters of the sub-family.

Eurycercus lamellatus, O. F. Mueller.

(Plate H, Figs. 5–6.)

Lynceus lamellatus, MUELLER, EDWARDS, KOCH, ZADDACH, LIEVIN, LEYDIG, ZENKER
Eurycercus lamellatus, BAIRD, LILLJEBORG, SCHOEDLER, P. E. MUELLER, KURZ, BIRGE, HERRICK.
Eurycercus laticaudatus, FISCHER, SCHOEDLER.

A gigantic lynceid, reaching the dimension of 3 mm. The figure of the male given will sufficiently illustrate the general form. The abdomen is broad and armed behind with a dense row of saw-teeth. The eye is larger than the rather small pigment fleck, and the intestine is bent upon itself but not coiled. The last foot is found in few other Lynceidæ. Acroperus has the same, and Pleuroxus uni

SUB-FAMILY II.—LYNCEINÆ.

Intestine coiled; anus near the end of the post-abdomen; opening of vas deferens nearly terminal. There are no anterior cæca but usually a single anal diverticle of the intestine. Rarely or never more than two embryos produced at once.

SERIES A.

Head or dorsal line keeled or ridged ; abdomen long ; shell marked with diagonal striæ. This section is proposed for the old genera Camptocereus, Acroperus and Alonopsis, which seem to form a natural group though passing directly into Alona.

II.—GENUS CAMPTOCERCUS (>*Camptocercus*, Baird).

This easily recognizable genus contains two groups, each with several nominal species, which are distinguished mainly by the width of the post-abdomen. In both the shell is elongated, more or less quadrangular, longitudinally striate, armed behind with one to four minute teeth. The head and back are keeled and the former strongly arched. The antennules rarely extend beyond the beak and are commonly curved laterally. The eye is proportionately small. The post-abdomen is long and furnished with a lateral row of scales. The terminal claws have a single basal spine and are serrate. There is an ephippium, and the male opening is in front of the terminal claws.

SUB-GENUS 1.—ACROPERUS, Baird.

Post-abdomen broad, margins parallel; anal teeth very minute lateral scales large and usurping their place. Antennæ with eight setæ $\left(\frac{300}{111}\right)$. Three species are described, one of which is very abundant in Minnesota.

Sp. 1. Acroperus leucocephalus, Koch.

(Plate E, Fig. 5. Plate I, Fig. 9.)

Lynceus leucocephalus, KOCH, FISCHER.
Acroperus harpæ, BAIRD.
Acroperus leucocephalus, SCHOEDLER, P. E. MUELLER, KURZ.
Acroperus sp., HERRICK.
Acroperus striatus, JURINE, M. EDWARDS, LIEVIN, LILLJEBORG, LEYDIG, etc., seems to belong here, but I am able to add nothing to the elucidation of the puzzle.

Body rounded above, angled behind; head moderately arched and carinated. Lower margin of the shell pectinate, terminating in two teeth. The antennæ are long and when reflexed the setæ reach nearly to the posterior margin of the shell. The posterior angle is not always as prominent as shown in fig. 5.

Sp. 2. **Acroperus angustatus,** Sars.

(Plate I. Fig. 10.)

Acroperus angustatus, P. E. MUELLER, KURZ.

This species is distinguished from the former by the head, which is higher and very strongly arched. The dorsal contour is nearly straight. The antennæ are shorter. The form of the post-abdomen of the male is less different from that of the female than in the above. The length of both species is about 0.7 mm.

The American form figured in fig. 5 of plate E differs from both the above slightly. The head is carinated and incurved almost as in C. angustatus; the antennæ fall a little short of reaching the posterior margin of the too low and oblong shell; there is an obvious depression between the head and body. However, in the main there is close agreement with C. leucocephalus, to which it has been previously referred. There is always a rudiment of an additional pair of feet.

A. cavirostris, P. E. Mueller, is not known in the female sex. The male has a twisted caudal claw.

SUB-GENUS 2.—CAMPTOCERCUS, Baird.

Although the general form is similar to the last section, the body is usually longer; the post-abdomen narrows toward the end; the anal teeth exceed the lateral row; the antennæ have usually but seven setae $(\frac{300}{310})$.

The species enumerated are so closely related as almost to baffle definition.

KEY TO THE SUB-GENUS CAMPTOCERCUS (verus).

Beak pointed.

- (a) Head depressed.
  - I. Pigment fleck larger than the eye.
    - 1. *C. biserratus*, SCHOEDLER.
  - II. Pigment fleck smaller than the eye.
    - 2. *C. macrurus*, O. F. MUELLER.
- (b) Head directed forward.
    - 3. *C. rectirostris*, SCHOEDLER.

Beak truncate below.

- 4. *C. latirostris*, KURZ.

Beak cleft below or with a forward projection.

(a) Antennules shorter than the beak.
- 5. *C. lilljeborgii*, SCHOEDLER.

(b) Antennules longer than the beak.
- 6. *C. rotundus*, HERRICK.

Sp. 1. Camptocercus biserratus, Schoedler.

(Plate I. Fig. 4.)

Is very nearly related to the next, from which it is distinguishe chiefly by the fact that the pigment fleck is larger than the eye Schoedler overlooked the fact that in C. macrurus there is a latera line of scales on the abdomen, and relied upon that character t distinguish this form. (Schoedler says that the pigment fleck in C macrurus is smaller than the eye, P. E. Mueller says they are nearl equal, while in our specimens they are much smaller or nearl equal.) If much variability is found, Schoedler's species seems to res on a slender basis. The basal spine of the claw, however, seems t be peculiar in sitting on a distinct prominence.

Sp. 2. Camptocercus macrurus, Mueller.

(Plate E. Fig. 10.)

Lynceus macrurus, LILLJEBORG, SCHOEDLER, P. E. MUELLER, KURZ, BIRGE, HERRICK

This universally distributed species occurs in our larger bodie of water and is not rare, though hardly abundant.

The body is long and nearly rectangular; the head strongl arched and keeled. The keel of the head is extended down th whole dorsal line. The dorsal line is moderately curved, while th shell is but slightly excavated below. The head extends into blunt beak looking downward; the direction of the head is somewhat variable (from vertical to an angle of about 30°). The eye i much larger than the pigment fleck; the antennules are shorte than the beak, and have one elongated terminal seta. The post-abdomen is very long and has numerous anal teeth as well as lateral row of scales. The basal spine of the claws is large and serrate, the claw itself being nearly straight and armed with an increasing series of spines to beyond the middle. The lateral scale of the post-abdomen are inconspicuous. The shell gland is long The antennules reach to almost the end of the beak, are curved an bear a lateral flagellum. The first foot of the female has a sort o hook (branchial sac?). The labrum is armed with teeth on th posterior face of the triangular process. The intestine is ver [illegible] feebly spined for three-fourths their length, and armed with from one to four teeth at the angle. Length 0.8 mm. to 1.0 mm.

Sp. 3. **Camptocercus rectirostris,** Schoedler.

(Plate I. Figs. 1—3.)

Camptocercus rectirostris, SCHOEDLER, P. E. MUELLER, KURZ.

Distinguished from the above, which it closely resembles, by the form of the head, which is less rounded and directed anteriorly. It hardly exceeds half the hight of the body. The beak is sharp. I am not sure that Weismann's figures (l. c., plate XI, figures 13 and 14) really belong to this species, for the drawing of the post-abdomen does not agree with that of P. E. Mueller fully. Outline copies of the former are given in plate I, figs. 1 and 2. The male has a hook upon the first foot. Not yet recognized in America.

Sp. 4. **Camptocercus latirostris,** Kurz.

(Plate I. Figs. 5—6.)

C. lilljeborgii, P. E. MUELLER (?).

Closely allied to the next, but distinguished by the position of the head, which is a little less depressed, and, especially, by the truncate beak. The dorsal margin is convex and crested; the lower outline is also convex. The claws are toothed more as in C. macrurus than the following. The basal spine springs from the claw itself and not from the post-abdomen as in the next. Length 0.9 mm. to 1.0 mm.

Sp. 5. **Camptocercus lilljeborgii.** Schoedler.

(Plate I. Figs. 7—8.)

Head depressed, rounded in front: beak divided at the end by the extension of the fornices. The terminal claws are pectinate for their entire length, and the basal spine is seated on the end of the post-abdomen. This species, in the main, closely resembles C. macrurus.

Sp. 6. **Camptocercus rotundus,** Herrick.

The second of the two species found in America is this short, strongly carinated form, which is known from a single gathering. It differs from all the above species, with which it agrees pretty well in shape, by its more compact form; high dorsal keel (which extends the entire length of the body); the long antennules, which extend far below the beak; and the somewhat pointed beak. The head is much as in the last, but it is not certain that the beak is cleft, although it has a peculiar form (not indicated in the figure) near the end. The length is 0.7 mm. The terminal setæ of the antennules are very unequal; but in most points, as in the armature of the post-abdomen, the details resemble C. macrurus.

III.—GENUS ALONOPSIS, Sars.

This curious genus includes three species of small lynceids, which exhibit a combination of characters. The form of the beak and head is like that of Pleuroxus, which the form and sculpture of the shell otherwise resembles. The back is extended more or less in a knife-like ridge above, thus resembling Acroperus, a resemblance hightened by the excavated lower margin. The form of the post-abdomen approaches that of Acroperus, but in that genus it is of about equal width throughout and in this it rapidly narrows. The internal organs and feet are of the typical lynceid form, while the antennæ are as in Pleuroxus.

The type of the genus, A. elongata, is apparently much closer to Acroperus than the two species which have been identified in America.

Shell sub-rectangular, high, produced into a ridge above; lower margin convex anteriorly, concave behind; beak rather long; antennules slender; antennæ with eight setæ; abdomen long, narrowed toward end, incised at the extremity; claw rather large, with median spines and a basal thorn; third foot with a long bristle. Male smaller, without the carina above; orifice of sexual organs in front of the claw, which is removed from the anterior margin. The young are more elongate and (sometimes) have hexagonal reticulations instead of the usual strong diagonal striæ. Motion slow.

Sp. 1. Alonopsis elongata, Sars.

Lynceus macrurus, LIEVIN.
Lynceus macrurus, ZENKER, LEYDIG.
Alona elongata, SARS.
Acroperus intermedius, SCHOEDLER.
Alonopsis elongata, P. E. MUELLER.

The shell is wide, the upper margin forming an even curve manifestly angled behind; ventral margin nearly straight, ciliated throughout, with a single tooth behind. Fornices large; head narrow, not carinate. Post-abdomen compressed, truncate at the end, armed with a series of marginal spines and of lateral scales; caudal claws large, with a single spine at the base and two median spines followed by a series of minute setæ

This form I have never seen, and it seems somewhat doubtful that the following really belong with it.

Sp. 2. Alonopsis latissima, Kurz.

(Plate E, Fig. 8. Plate G, Figs. 1 and 9.)

Body very high, compressed, with a high dorsal keel or ridge; the upper outline strongly and evenly arched, terminating behind in no angle; lower margin almost angled at the anterior third, rounded behind, fringed with long bristles anteriorly, with short ones posteriorly. Head very narrow; beak extremely long; fornices small; antennules nearly as long as the beak, straight and narrow; pigment fleck smaller than the eye. The abdomen is long, somewhat narrowed toward the end, where it is deeply cleft; the terminal claw is furnished with a large and small basal spine, while there is an increasing series of spines extending to the middle.

The elongated spine of the third foot is pectinate and reaches nearly to the posterior margin of the shell. The shell is marked by few strong striæ which are diagonal except anteriorly where are a few parallel to the front margin. The male is small and lacks the crest on the back, while the lower margin is straight; the antennæ are longer than the beak and differ somewhat from those of the female. The first foot has a claw. The post-abdomen lacks the anal teeth. Kurz gives the size as 0.5 mm.

The American form varies between 0.45 mm. and 0.55 mm., and seems to have a higher dorsal keel and longer beak. Kurz speaks of but a single accessory spine on the terminal claws; there is, however, a second very minute spine or cluster of hairs in this as well as the following.

Found in the same gathering with the following near Minneapolis (marshy off-set from Bassett's creek near Oak Lake Addition).*

*NOTE TO ALONOPSIS LATISSIMA. (See Fig. 1, Plate G.) Since writing the above the males of our American form have been found; they are shaped as the females, with a high dorsal keel; the post-abdomen is rounded, with transverse series of small bristles; the claw has a minute median spine, and the *porus genitalis* is anterior and elevated.

Sp. 3. Alonopsis media, Birge.

(Plate E. Fig. 9.)

I give Birge's description verbatim:

"Rostrum prolonged, and shell sharp, somewhat quadrangular in shape, marked by striæ. The dorsal margin is convex, the hinder margin nearly straight. Its lower angle is rounded and without teeth. The lower margin is concave and has long plumose setæ.

The front margin is strongly convex. The post-abdomen is long and slender, resembling that of Camptocercus, and is notched at the distal extremity; it has two rows of fine teeth and some fine scales above them. The terminal claws are long, slender, with a basal spine, a spine in the middle, and are serrated. The antennules are long and slender, but do not reach to the end of the rostrum. They have each a flagellum and sense hairs. The antennæ are small and have eight $\binom{300}{311}$ setæ and two $\left(\frac{100}{100}\right)$ spines. The labrum resembles that of A. leucocephalus, but is slightly prolonged at the apex. The intestine, cæcum and color resemble those of Acroperus. There is a trace of a keel present on the back."

The specimens seen in Minnesota resemble this species very nearly, apparently, but there are some differences. The terminal claw of the post-abdomen has an increasing series of spines to the middle; there seems to be no lateral row of scales beside the anal teeth; the abdomen is rather broad at the base and narrows toward the end. The shell is not square behind. The lower margin has a few long hairs anteriorly which are followed by a series of teeth, and in the concave part a somewhat longer set to a point just before the lower curved angle.

The pigment fleck is nearly or quite as large as the eye. The antennule is shorter than the beak (which is almost as in Pleuroxus hastatus), and has a flagellum about midway; at its base it is narrowed and inserted on a prominence.

The embryo still in the brood sac had a more elongate form and hexagonal reticulations upon the shell, while the antennules were longer than the very long beak, and the pigment fleck was smaller than the eye. Length of female 0.52 mm. The color is darker, and the striæ more numerous, than in A. latissima.

SERIES B.

This section includes forms with (usually) no keel above, or, if keeled, the post-abdomen is not long. The majority are highly arched dorsally, and have comparatively short post-abdomen and pointed beak. The antennæ are usually feeble and the motion slow

A. **Post-abdomen** nearly round in outline, armed with very long stout spines, terminal claw with one minute basal spine or none; greatest hight of shell about equal to the posterior margin.

1. Genus *Leydigia*.

B. **Greatest** hight of shell moderately exceeding that of posterior margin; post-abdomen more or less triangular, armed with bristles; shell marked with hexagona meshes.

(a) **Head** nearly horizontal, blunt; post-abdomen prominent in the anal region.

2. Genus *Graptoleberis*

(b) Head depressed, acute ; post-abdomen excised near the anus.
3. Genus *Crepidocercus*.

C. Post-abdomen more or less quadrangular, armed with one or two rows of small teeth on either side behind ; terminal claws with one or two basal spines ; hight of posterior shell margin usually less than the greatest hight of shell.
4. Genus *Lynceus*.

D. Greatest hight of shell little less than that of posterior shell margin ; post-abdomen terete ; terminal claws very minute.
5. Genus *Phrixura*.

E. Greatest hight of shell more than double that of posterior margin.
(a) Eye and first foot normal.
6. Genus *Chydorus*.
(b) First foot with a claw which extends beyond the shell.
7. Genus *Anchistropus*.
(c) Eye absent, only pigment fleck used for vision.
8. Genus *Monospilus*.

IV.—GENUS LEYDIGIA, Kurz.

In this genus, both the known species of which are found in America, the posterior part of the shell and body is emphasized at the expense of the anterior. The curved posterior margin is equal to the greatest hight of the shell. The head and anterior part of the body are of the form characteristic of Alona; indeed, the whole body is in plan like Alona, but in the back part the organs are all enlarged. The general form of the body and abdomen recalls Ilyocryptus; the post-abdomen, in particular is very like that genus. The last two pairs of feet are much enlarged. The shell is usually irregularly marked with longitudinal striæ; the lower margin is covered with long spine-like setæ. The post-abdomen is armed with several sets of long spines and aggregations of bristles and small spines; it is almost round and enormously enlarged. The intestine is coiled and expanded at the end, but the anal cæcum is rudimentary. The antennæ are heavily spined and have eight setæ; the labrum is more or less hairy. The male has a strong hook on the first foot, and between the terminal claws of the abdomen is a peculiar intromittent organ.

Sp. 1. **Leydigia quadrangularis**, Leydig.

(Plate H. Fig. 4.)

Lynceus quadrangularis, LEYDIG, FRIC.
Alona leydigii, SCHOEDLER, P. E. MUELLER.
Leydigia quadrangularis, KURZ.

The shell is comparable to that of Alona quadrangularis, but higher behind; the markings are not very distinct; shell transparent. The head is very small; the eye smaller than or of about the size of the pigment fleck. The post-abdomen is very broad, the posterior margin nearly the segment of a circle, armed with numerous very long unequal spines which extend only about half the hight, being replaced by short close hairs; the anal opening is very high; the terminal claws are long, straightish, and have a small thorn near the base.

The males are smaller than the females, and the abdomen is less broad; the antennules are longer than the beak and furnished with a flagellum. The sexual period occurs in September or irregularly. This species has only been encountered once, during September, in Poplar river, Cullman county, Alabama.

Sp. 2. Leydigia acanthocercoides, Fischer.

Lynceus acanthocercoides. FISCHER, LEYDIG.
Eurycercus acanthocercoides, SCHOEDLER.
Alona acanthocercoides, P. E. MUELLER.
Leydigia acanthocercoides, KURZ.
Leydigia quadrangularis, HERRICK.

This species, reported in a previous paper, is, as was said, nearest like L. acanthocercoides; and I am now able to verify the very inconspicuous differences upon which the two are separated. Our specimens of the L. quadrangularis have the pigment fleck fully as large as the eye, Kurz to the contrary notwithstanding, and the claw of the post-abdomen is present, while in the present species the pigment fleck is much larger and furnished with lenses; the spine of the claw is wanting; the labrum is densely hairy; the abdomen is narrower, and the shell higher. The shell is very obviously striped in the posterior portion. The anus is higher than in the previous species. In other respects the two seem alike.

V.—GENUS GRAPTOLEBERIS, Sars.

A genus containing two closely allied species, having some affinities with Alonella. The shell is entirely reticulated, and there is a sort of crest along the back; while, on the other hand, the head is flattened and rounded in front. There can hardly be said to be a beak. Seen from above, the animal resembles some species of Alonella, but the head is larger proportionally and more horizontal. The lower posterior angle is spined. The antennæ have seven setæ and are very long, in this respect resembling Camptocercus. The dorsal contour is not greatly arched. The post-abdomen has short claws and anal bristles, but no teeth.

Sp. 1. Graptoleberis testudinaria, Fischer.

Lynceus testudinarius, LEYDIG, LILLJEBORG.
Lynceus reticulatus, FRIC.
Alona testudinaria, SCHOEDLER.
Graptoleberis testudinaria, KURZ.
Graptoleberis inermis, BIRGE.

Form trapezoidal; lower margin straight, armed behind with two teeth, thickly beset with long hairs in front; the dorsal margin is not greatly elevated, rounded at the posterior angle, forming a slight "hump" where it unites with the head shield. The head and shell are reticulated with hexagonal or quadrangular markings. The shell gapes below and rises to a sharp ridge above. The antennæ have long rami, the antennules being hardly longer than the fornices. The eye is large; the pigment fleck is small. The post-abdomen is narrowed toward the end, rounded in front; the terminal claws are small and have two basal teeth. The dorsal margin of the post-abdomen is covered with tufts of hairs. The winter eggs have no ephippium. Length 0.55 mm. to 0.7 mm. The male is smaller and has a lower dorsal keel; the post-abdomen is excavated behind.

The only differences between the Minnesota specimens and the typical European form seemed to be the absence of the very minute spines on the front of the terminal claws. The eye and pigment fleck are of about the proportions figured by Kurz. Birge's figure of the post-abdomen does not agree with his description fully. Our Minnesota specimens have an obvious but not high keel.

Sp. 2. Graptoleberis reticulata, Baird.

Alona reticulata, BAIRD, P. E. MUELLER.
Lynceus reticulatus, LILLJEBORG, LEYDIG.
Alona esocirostris, SCHOEDLER.
Graptoleberis reticulata, SARS, KURZ.

Shell almost rectangular, reticulate, ventral margin straight, ciliate anteriorly, with two teeth behind. Pigment fleck smaller than the eye. Post-abdomen short, narrowed towards the end, dorsally covered with clusters of spines; caudal claws with a minute tooth at the base. Length 0.4 mm. to 0.5 mm.

The pigment fleck is nearer the end of the beak than the eye, and is smaller than in the previous species, but, on the whole, there is, perhaps, too great similarity.

VI.—GENUS CREPIDOCERCUS, Birge.

The characters of this group place it rather near Alonella or between that and Pleuroxus. Form sub-quadrate with rounded angles; dorsal line uniformly arched, terminating in a sharp angle behind; lower margin convex, armed behind with a single spine as in Pleuroxus unidens, and along the entire length with loose setæ. Beak of moderate length, acute. Post-abdomen deeply incised in the anal region; lower posterior margin straight, rounded at the apex; ventral margin straight or concave; claws with a single basal spine and a few teeth. The post-abdomen is shoe-shaped and armed with transverse rows of setæ.

The antennæ are large, having eight setæ and the usual spines. Shell smooth or reticulate.

Sp. 1. **Crepidocercus setiger,** Birge.

(Plate F. Fig. 13.)

Length 0.4 mm. to 0.5 mm. Minnesota specimens measured 0 5 mm. This, the only species of the genus, is but rarely encountered, and is so peculiar as to be easily recognized when seen. Alona intermedia has a post-abdomen with clusters of bristles, but in Crepidocercus the post-abdomen is more as in species of Graptoleberis than any other genus. The markings upon the shell are very indistinct.

VII.—GENUS LYNCEUS, O. F. Mueller.

The perplexing inter-relations between the three genera Alona, Alonella and Pleuroxus give rise to the utmost confusion. No two authors are agreed as to their respective limits, and the points given by Kurz, who has carefully gone over the ground, are obviously insufficient. Although there may be practical benefits to be derived from the continuance of the nomenclature in use for groups which in the general view can be distinguished, the value from a theoretical standpoint is reduced to a minimum.

The genus Camptocercus (including here Acroperus, which differs solely in the form of the abdomen, as a sub-genus) passes through Alonopsis into the group represented by Alona. Leydigia, although very near such forms as Alona quadrangulata, may be conveniently distinguished as a transition to species like Ilyocryptus.

Phrixura, Graptoleberis and Crepidocercus, each containing few species which can be readily recognized, fill a place in the system; but it is practically impossible to distinguish Alona from Pleuroxus without instituting the very indefinite genus Alonella to contain a variety of small intermediate forms. Percantha, Rhypophilus, Harporhynchus and Pleuroxus seem to be pretty generally regarded as constituting a single group which may be recognized by the long rostrum, high shell and greater development of the antenna bristles. Alona, on the other hand, with its broader fornices, shorter beak, fairly developed antennæ, and more rectangular shell, is, perhaps, the pivotal point of the group. According to this view, then, the old name *Lynceus* is revived for the aggregate; and the other names are retained, in part, as titles of largely conventional groups or sub-genera, thus:

Genus Lynceus.

- Sub-genus Alona.
  - Section A. *Alona vera.*
  - Section B. *Alonella.*
- Sub-genus Pleuroxus.
  - Section A. *Pleuroxus verus.*
  - Section B. *Leptorhynchus.*[1]

Characters of Percantha and Rhypophilus are combined in the species P. procurvus, Birge, so that one must be dropped or new diagnoses formulated. I am not sure that the same species is not at first Pleuroxus verus[2] and only later assumes the form known as Rhypophilus. So with Percantha the amount of serrature of the posterior margin is in part a question of age.

Sub-genus Alona.

This group contains two sections which resemble each other in form and, in general, in detail; but it is exceedingly difficult to formulate a diagnosis that shall strictly limit it. The form is generally sub-quadrangular with rounded corners; the terminal claw is armed with but a single spine at the base; the beak is rather short; and the prevailing marking consists of longitudinal lines.

Section A. *Alona* (*vera*). Baird.

This genus contains a large number of minute animals which are widely distributed.

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[1] Instead of Harporhynchus, a name preoccupied in zoology.

[2] Embryos of P. procurvus have the part which is to be curved forward attenuated before leaving the brood-cavity, however.

The authors who have done the most to elucidate this genus are Schoedler, P. E. Mueller, and Kurz. Birge has contributed most largely, thus far, to the knowledge of American species, which are, for the most part, identical or very close to the European. No other genus is so difficult among the Lynceidæ, for the most minute differences are relied upon to distinguish species. The species of this genus are not greatly altered by the production of the winter eggs. The males are frequently but little smaller than the opposite sex, and are recognized by the altered form of the post-abdomen and the presence of a hook on the first foot. The form is more perfectly rectangular than in the next section; the shell is only exceptionally reticulated and very rarely tuberculate, occasionally smooth. The lower angle of the shell is not armed with spines, but is generally rounded. There is only one basal spine upon the claw of the post-abdomen, which usually bears a row of scales beside the anal spines. The antennæ have eight setæ. The claw of the male post-abdomen is removed from the lower angle.

About twenty species are known, all of which that seemed recognizably defined have been included in the following key, which is believed to be more nearly natural in its arrangement than that of Kurz, which would separate the European and American representatives of the A. parvula group. Many more forms remain to reward the labor of American students. Those mentioned from Minnesota could probably all be found by a few days search in one locality.

KEY TO SECTION A, ALONA.

A. Shell reticulate.
  (a) Reticulations horizontal.
    1. *A. guttata*, Sars.
  (b) Reticulations oblique.
    2. *A. angulata*, Birge.

B. Shell lined, smooth or tuberculate.
  (a) Over 0.5 mm. in length.
      I. Shell densely striate.
    3. *A. sanguinea*, P. E. Mueller.
      II. Shell normally, evidently striate.
    * Post-abdomen narrowed at the end.
    † Armed with elongate teeth below.
    4. *A. tenuicaudis*, Sars.
    †† Teeth of post-abdomen nearly equal.
    5. *A. lineata*, Fischer. (Shell arched.)

6. *A. modesta*, Herrick. (Shell straight above.)
** Post-abdomen not narrowed.
† Antennæ with seven setæ.
(?) 7. *A. costata*, Sars.
†† Antennæ with eight setæ.
8. *A. quadrangularis*, Mueller.
III. Shell faintly, irregularly striped; eye of same size as pigment fleck.
9. *A. oblonga*, P. E. Mueller.
IV. Shell smooth.
10. *A. affinis*, Leydig.
(b) Under 0.5 mm. in length.
I. Post-abdomen armed with a row of hairs terminating in large teeth.
11. *A. dentata*, P. E. Mueller.
II. (One or) two rows of teeth present.
* Shell densely and evenly striate.
12. *A. elegans*, Kurz.
** Shell not densely lined.
† Shell smooth or lined longitudinally.
‡ Teeth of post-abdomen unequal, the lower ones enlarged.
13. *A. porrecta*, Birge.
‡‡ Teeth nearly equal.
§ Form elongated ; abdomen with a lateral line of spiny scales.
14. *A. spinifera*, Schoedler.
§§ Form squarish ; abdomen with a lateral line of simple spines or bristles, or neither.
15. *A. parvula*, Kurz.
16. *A. glacialis*, Birge.
‡‡‡ Clusters of bristles, not spines, on the posterior edge of the post-abdomen.
17. *A. intermedia*, Sars.
†† Shell smooth or tuberculate.
18, 19. *A. tuberculata*, Kurz, Herrick.

Sp. 1. Alona guttata, Sars.

A small species of sub-quadrangular form. The beak is very short: the eye small, but larger than the minute pigment fleck. The shell is short, with a rounded posterior angle and marked by hexagonal or rectangular meshes running about parallel with the lower margin. The post-abdomen is of moderate size, rounded at the apex, with a series of stout teeth behind; the terminal claw has a minute basal spine. P. E. Mueller, in Danmark's Cladocera, confused this with A. intermedia, which he described under this. The post-abdomen in that species is larger, less rounded behind, and armed with clusters of spines instead of teeth. The length is about 0.3 mm. in both.

Sp. 2. Alona angulata, Birge.

Dorsal margin considerably arched, terminating in a more or less obvious angle at the hinder corner; the hinder edge is convex, as is also the front margin; the ventral margin bears plumose setæ. Beak pointed, extending nearly to level of ventral margin of the valves. Fornices broad, Shell obviously striated diagonally and less obviously marked by cross lines. Post-abdomen broad, truncate; about twelve anal teeth, with a series of scales and hairs back of them. The pigment fleck is much smaller than the eye. Male smaller; beak shorter; post-abdomen with a lateral row of hairs; anterior feet hooked; sculpture less distinct. [Birge.] Length of female 0.4 mm; male 0.35 mm.

Sp. 3. Alona sanguinea, P. E. Mueller.

(Plate I. Fig. 20.)

Body nearly rectangular; ventral margin nearly straight, with short setæ; posterior angle rounded, unarmed. Beak short; pigment fleck much larger than the eye. Post-abdomen large, the end truncate, broadened; posterior margin rounded, with a series of spines and a lateral row of scales; terminal claw with a small spine. The shell is ornamented with fine, close, longitudinal striations. Length 0.9 mm. Alona elegans is very near to this and should have followed. In August, 1878, I took an Alona marked as in A. sanguinea and agreeing with Mueller's description in all points which can be verified in the drawing. The small size of the eye is remarkable for so large an animal. I have never again seen this species; it seems to be very rare here and in Europe.

Sp. 4. Alona tenuicaudis, Sars.

(Plate I. Fig. 11.)

Alona tenuicaudis, SARS, P. E MUELLER, KURZ.
Alona camptocercoides, SCHOEDLER.

Form nearly rectangular; ventral margin rounded, with long setæ, posterior angle rounded. Beak short, pigment fleck smaller than the eye. Post-abdomen with sides parallel, long, incised below; lower angle armed with about six strong teeth, remainder of the series small; a lateral line of scales present; claws with a strong basal spine. The shell is striate with longitudinal lines. Length 0.5 mm.

One of the most easily recognized species; not identified in America.

Sp. 5. Alona lineata, Fischer.

Lynceus lineatus, FISCHER, LEYDIG.
Alona lineata. SCHOEDLER, P. E. MUELLER, KURZ.
Alona rectangularis, SARS.

The upper margin is rounded, the lower one somewhat sinuate, with setæ of moderate length. The beak is tolerably long, reaching nearly to the level of the lower margin of the shell; the pigment fleck is less than the eye, to which it is much nearer than to the end of the beak. Post-abdomen short, broad and tapering toward the end, truncate, armed with about ten large teeth; caudal claws with a small basal tooth. Shell marked with distinct lines running horizontally. The ephippial females are recognized by a deep color and the greater elevation of the back. Length 0.5 mm., 0.6 mm. The male has a weak hook on the first foot, and the post-abdomen is narrowed toward the end; the terminal claw has no spine.

The Minnesota representative of this widely distributed species differs in some respects. The lower margin is nearly straight and rather sparsely hairy; the beak is blunt, but, on account of the spreading of the extremely wide fornices, does not appear so except under pressure.

The beak reaches nearly to the lower shell margin. The antennules are narrow, one or more of the setæ being elongated. The dorsal margin is either nearly straight or strongly arched behind; in either case the greatest hight of the shell is back of the middle. The pigment fleck is large. The post-abdomen is just as in A. lineata, but the lateral row seems to be of spines rather than fringed scales. The shell is marked by rather evident or indistinct lines. The form agrees pretty well with Schoedler's figure, except that the posterior shell margin is much higher. The antennæ have eight setæ, but the last one is very weak. The terminal setæ seem sometimes to be spined, as figured by Schoedler, but in some specimens they are perfectly smooth. There is a circlet of spines on the second joint of the setose ramus. There is a hair on the inner aspect of the protuberance of the labrum. The eye is somewhat nearer the pigment fleck than is the end of the beak. If it is desirable to apply a new name to a form at least so near the European A. lineata, it may bear the name first given it in my

? Sp. 6. Alona modesta. (Sp. n.)

(Plate H, Fig. 3; and Plate Q, Fig. 4.)

The length varies between 0.41 mm. and 0.55 mm. The smaller forms have the back most rounded, while a specimen 0.55 mm. long will appear very like A. quadrangularis. Males are elongate; hook of first foot strong, accompanied by a heavy growth of small spines; terminal claw of abdomen with a minute spine.

? Sp. 7. Alona costata, Sars.

Founded practically upon the absence of the eighth seta of the antennæ. The description given by Sars will not render it recognizable so that there is no occasion to repeat it here. In all the species of this section the eighth seta is small and may be absent.

Sp. 8. Alona quadrangularis, Mueller.

(Plate E. Figs. 1—2.)

Alona sulcata, SCHOEDLER.
Alona quadrangularis, P. E. MUELLER, KURZ, HERRICK. The further synonomy of the species may well be doubtful, for there are species so closely allied as to render a strict determination difficult.
Lynceus quadrangularis, O. F. MUELLER, is the name employed, and is thought to be identical with the Alona quadrangularis of Baird.

Shell quadrangular, highest behind; lower margin straight; posterior margin curved; lower angle rounded, striped with rather evident lines which are parallel and straight. The beak is quite long; the pigment fleck is smaller than the eye. The post-abdomen is broadest near the end, where it is strongly rounded; the numerous anal spines are strong and emarginated, supported by a lateral series of scales; the terminal claw and its basal spine (in American forms) are denticulate (Kurz says smooth in European specimens). The feet are of the typical Alona form (see plate E, fig. 1). The shell gland is rather conspicuous; no true ephippium. The abdomen of the male lacks the spines, but is otherwise similar. Length 0.6 mm. to 0.7 mm. Less abundant in Minnesota than the next. Both this and the following species were recognized in 1878, but were thought to be the same species. (See *Microscopic Entomostraca*, p. 109.)

Sp. 9. Alona oblonga, P. E. Mueller.

Alona oblonga, KURZ, BIRGE.
Alona quadrangularis, LILLJEBORG.

Differs from A. quadrangularis in the following points:—the greatest hight of the shell is anterior to the middle; the lines are the end and lacks the teeth. Lakes about Minneapolis.

(A small form of A. quadrangularis in lake Calhoun had the eye and pigment fleck equal and the terminal claw smooth.)

Sp. 10. Alona affinis, Leydig.

(Plate F. Fig. 14.)

Lynceus affinis, LEYDIG.
Alona affinis, SCHOEDLER.

Form sub-quadrangular; hight about once and one-half in length; the dorsal outline forming a regular and low curve from end of head to upper posterior margin; lower outline very slightly sinuate, anterior one not at all: posterior angles rounded; head nearly horizontal; eye of moderate size; pigment fleck considerably smaller; antennules rather large, with unequal sensory hairs at the end, one spine just above the end in front and a bunch of minute hairs near the base behind; antennæ comparatively large, basal joint spiny. outer ramus with three setæ, two of which have thorns at their middle, also a terminal spine; inner branch with two of the terminal setæ thorned and the upper lateral seta reduced. The post-abdomen is very broad and short, expanded below and rounded at the end; the terminal claws are straightish, denticulate, and the spine at the base is also dentate; there is a series of heavy spines on the upper margin of the post-abdomen, accompanied by a series of scales on the side. The shell is unornamented and fringed below with short bristles. Length 0.9 mm., or more. This fine species is recognized by its smooth shell, the horizontal position of the head, and the form of the post-abdomen; it belongs among the largest of the genus. Lakes near Minneapolis, not rare.

Birge quotes A. spinifera from Wisconsin. In all probability that species is the younger stage of the above.

Sp. 11. Alona dentata, P. E. Mueller.

(Plate I. Figs. 12—13.)

Form sub-rectangular, somewhat arched above, obscurely longitudinally striated; lower angle obtuse, margined below with short setæ. Post-abdomen small, slender, armed with a lateral line of scales and two strong teeth at the lower angle; claw with a minute basal spine. The form of the post-abdomen is identical with "Harporhynchus" falcatus, Sars, which this species also resembles in having the pigment fleck larger than the eye, and in general form and the character of the striation. The beak, however, is very short. In size P. E. Mueller says it is among the smallest of the genus.

Sp. 12 Alona elegans, Kurz.

(Plate I. Fig. 14.)

Form rectangular; back slightly elevated, posterior margin high, lower margin straight. Shell covered with minute striations springing from the region of the attachment of the head shield. Head rather large, pigment fleck smaller than the eye. The antennæ have eight setæ and a circlet of spines on the second joint of the inner ramus, and a single thorn on its first joint. The post-abdomen is short and broad, rounded at the end, and is armed with about ten anal teeth and a lateral row of scales. Length 0.4 mm.-0.5 mm.

Sp. 13. Alona porrecta, Birge.

Sub-rectangular ; ventral line nearly straight; valves marked by longitudinal striæ; beak short. Post-abdomen truncate, with about twelve teeth, three or four of which at the end are larger, and a row of hairs above the teeth. Male similar. Length 0.34 mm. Distinguishable from the following small species in the armature of the post-abdomen.

Sp. 14. Alona spinifera, Schoedler.

If not the young of A. affinis, this little species mimics it very closely. The head is less horizontal and more acute than in that species, otherwise almost identical excepting in size which is about one-third. The sensory setæ of the antennules are said to be nearer equal. Found by Birge in Massachusetts and Wisconsin, but not yet encountered in Minnesota.

I do not know how to distinguish this certainly from A. parvula. It, however, seems to have the lower angle of the post-abdomen less squarely truncate and the incision less obvious. Birge says that the abdomen is rounded. I have found specimens which apparently belong here, with the post-abdomen rather sharply angled and deeply incised; there were about fourteen teeth with a row of hairs in front. The form is hardly to be distinguished from another variety which has a shorter post-abdomen, rounded below, and with only about seven or eight teeth and with a smooth shell. This form passes directly into a tuberculate variety, having the post-abdomen similar but the shell covered with numerous rows of tubercles. Sometimes a transition from a lined shell to a tuberculate shell is seen (as in plate G, fig. 14). Alona tuberculata, Kurz, is said to have a truncate and incised post-abdomen with no lateral row of hairs. Birge thinks these identical; if so, our form referred to A. glacialis is identical with A. parvula. There is also a form found with the above in which no markings are visible and the shell is considerably arched; these were, however, nearly all ephippial females or approaching that period.

(**19.**) **Alona glacialis** (?), **var. tuberculata,** (Var. n.)

(Plate G. Figs. 4—7 and 14),

will, then, be our tuberculated Alona with a lateral row of scales and a series of fine spines along the anus.

Alona glacialis (?). **var. lævis,** (var. n.)

is the smooth form with higher dorsal margin.

The antennæ of the two last have spines at the end of the rami of the antennæ, a circlet of spines on the outside of the second joint of the setose ramus, and a spine on the basal joint of the other ramus; two of the setæ at the end of the setose ramus have spines at the angles. The males found among the above small forms have the same characters as var. lævis and the abdomen is rounded at the end; the claw is situated in the middle of the lower margin, in front being the opening of the *porus genitalis* and behind a cluster of hairs; the spines are absent, but there is a lateral row of long bristles. A strong hook is found on the first foot. Length 0.3 mm

Sp. 17. Alona intermedia, Sars.

(Plate I. Fig. 15.)

Alona guttata, P. E. MUELLER.

Form sub-rectangular, rounded below; beak short; shell marked by longitudinal lines, which may be broken into indistinct rectangular meshes. Post-abdomen short and wide, rounded at the end, ornamented by clusters of minute spines behind as well as a lateral row of scales. About 0.3 mm. long.

Section B. ALONELLA, Sars.

In this group are included small species with a combination of characters, forming the link between Alona and Pleuroxus. An obvious character is the fact that the shell is usually partly marked by oblique striæ, which run in two directions: first, a set extending forward and upward from the lower posterior angle of the valves; second, a set springing from the anterior and lower angle, running across the others. At the central part where these two series intersect, they each become zigzag; the result is a series of hexagonal markings, which may extend to the middle of the lower margin.

The beak is short and the fornices broad; the shell is more or less rectangular, but somewhat elevated in the middle above.

There are usually but seven setæ on the antennæ, or the eighth a minute hair; on the ramus having the lateral setæ one of the rminal setæ is frequently reduced. In many cases the whole hell is marked by minute striæ in addition to the proper markings, ut this is also found in some species of the true Pleuroxus. Kurz gives, as a character of Alonella, the presence of but a single basal spine to the claw of the post-abdomen; but P. E. Mueller figures two spines on the claws of one of his species (A. exigua), and Schoedler figures eight setæ on the antenna of A. excisa. American specimens of A. excisa and of A. pygmæa both certainly have a very minute eighth seta. There remains, therefore, positively no point which can be relied upon to distinguish these little lynceids from Pleuroxus or Alona. Perhaps, however, these species, as a group, may be recognized by what has already been said. Three species are found in Minnesota.

A. Rostrum long, bent backwards.
  1. *A. rostrata*, Koch.

B. Rostrum short.
  I. Lower posterior angle toothed.
  (a) Shell more or less reticulate.
    * Reticulated areas minutely striate.
  2. *A. pulchella*, Herrick.
  3. *A. excisa*, Fischer.
    ** Reticulated areas smooth.
    † Head depressed.
  4. *A. exigua*, Lilljeborg.
    †† Head horizontal.
  (?) 5. *A. grisea*, Fischer.
  (b) Shell marked by lines running diagonally upward and backward.
  6. *A. pygmæa*, Sars.
  II. Lower posterior angle smooth, shell longitudinally striate.
  7. *A. striata*, Schoedler.

Sp. 1. Alonella rostrata, Koch.

Lynceus rostratus, KOCH, LILLJEBORG, SCHOEDLER.
Alonella rostrata, SARS, KURZ,
Alona rostrata, P. E. MUELLER.

Body long, rapidly narrowed behind; dorsal line strongly arched in front toward the depressed head; the lower margin straight, with 0—3 small teeth at the angle. The fornices are broad, but the beak is sharp; the pigment fleck is but little smaller than the eye, to it is three times nearer than to the beak. The post-abdo- as in A. excisa, but longer. Length 0.4—

0.5 mm. Schoedler says the lower margin is concave and the angle unarmed, a condition not inconsistent with specific identity, as can be seen in many other species. The shell seems to be variably marked, but most conspicuous are the diagonal, curved striæ. Schoedler compares the sculpture to P. exiguus; Kurz, however, leaves the impression that only slight reticulation is present in the female.

The male has the post-abdomen narrowed, ornamented with clusters of hairs behind, and the small claws have no basal spine, while the genital opening is in front of the claws.

Sp. 2. **Alonella pulchella.** (Sp. n.)

(Plate Q. Figs. 1—3.)

A minute form very recently obtained is described under the above name. Although closely allied to A. exigua, this species is more like Graptoleberis than any other member of the genus. It is the smallest of the lynceids, excepting A. pygmæa. The shell is high and rather strongly arched; the posterior margin is short and armed with four teeth below, which point in different directions as in Graptoleberis. The head is short and the antennules long. The pigment fleck is of moderate size, but smaller than the eye. The post-abdomen is short, rounded below, and armed with sharp and small anal teeth, besides which is an inconspicuous row of minute setæ. The claw is very small, and has a single very minute tooth. The shell is marked by reticulations, which below are regular hexagons but above pass into elongated meshes, and finally on the beak and head become longitudinal striations. The areas are lined as in A. excisa. Thus this species combines the form of abdomen of A. exigua with the teeth of Graptoleberis and the markings of A. excisa.

Length hardly 0.27 mm. Motion active. The specimen figured contained a single large ovum. The head may possibly have been somewhat protruded by pressure. Habitat, vicinity of Minneapolis.

Sp. 3. **Alonella excisa,** Fischer.

(Plate E, Fig. 6; and Plate G, Figs. 10. 11.)

Lynceus excisus, FISCHER.
Pleuroxus excisus, SCHOEDLER.
Alonella excisa, KURZ.
? Pleuroxus insculptus, BIRGE.

This species is closely allied to Alonella exigua; yet that species shows appreciable differences, (which can hardly be claimed, perhaps, for Pleuroxus insculptus.) The various authors who have written of this lynceid have all laid emphasis upon the sculpture of the shell, almost to the exclusion of other points in the description. Prof. Birge has found a quite different form, apparently, which has the same peculiar markings; and even the common Alona oblonga has a part of the valves covered by minute striations. Schoedler's figure of this species is unrecognizable; but, as identified by Kurz, the species seems undoubtedly the same that is common in shallow pools in Minnesota, during autumn, and probably also in Massachusetts.

The variations to which this species is subject are considerable and may account for the marked disagreement in the accounts of our different authors. Schoedler gives his specimens a length of .20-.25 mm., while Kurz says .35 mm. Birge gives .27 for the length of Pleuroxus insculptus, and our specimens varied in the same gathering between .24 mm. and .40 mm. Schoedler figures three teeth at the lower posterior angle; Kurz says "several (4);" Birge describes one or two, and Minnesota specimens show gradual transitions from an inconspicuous angle to three or perhaps four teeth. These teeth are the extensions of some of the strong ridges or crenulations which mark the shell. P. E. Mueller's figures of the shell and abdomen of P. exigua would apply to our species perfectly, save the absence of minute striations; Kurz's statements with reference to the differences bet-tween these two forms seem to agree only in part with those of Schoedler. I must here express my suspicion that the Pleuroxus aculeatus, P. exiguus and P. excisus all belong under this species. I have seen a small form which lacked the fine striations; and there appeared to me to be, at times, a slight indication of a second series of hairs upon the post-abdomen.

The form is oblong, truncate behind, variously arched above, but usually with a rather low, evenly curved dorsal contour; the lower shell margin is either nearly straight or convex in front and concave along the posterior third, and is heavily beset with very long pectinate bristles. The head is moderately depressed, with a very broad, blunt and short beak (in some positions this beak seems acute, but it is an optical delusion); the fornices are very broad, covering the antennules completely; seen from above the head is broad and truncate in front; the eye is larger than the large pigment fleck, which is nearer it than the end of the beak. The antennæ have eight setæ, the last of which is minute; the five-spined ramus has a strong thorn on the end, and the inner terminal seta is reduced. The post-abdomen is rather broad and truncate or somewhat rounded below; its length is very variable, being short in small individuals; its form is subject to concomitant variations. The seven to eleven anal spines extend in a series of minute bristles above the anus. The lower posterior angle of the shell bears one to four teeth; the marking consists of wavy ridges and striæ, producing, by the crossing of two sets springing from the two lower angles, a reticulation covering more of less of the entire shell. The head-shield and the spaces between these markings are densely striated. Color yellowish, often opaque. Length 0.24.-0.40 mm. At times abundant. Birge alone has seen the males; his description agrees with Kurz's account of the male of A. exigua, save that the former speaks of spines, and the latter of thorns, along the post-abdomen.

Sp. 4. **Alonella exigua,** Lilljeborg.

Lynceus exiguus, LILLJEBORG, LEYDIG, FRIC.
Alonella exigua, SARS, KURZ.
Pleuroxus exiguus, SCHOEDLER, P. E. MUELLER.
? *Lynceus aculcatus*, FISCHER.

Aside from the differences in the male sex as above indicated, this form is said to have a convex lower margin, a rounded post-abdomen, and the pigment fleck nearer the end of the beak than the eye, The absence of the fine striation, finally, is the most marked characteristic. Length 0.30-0.33 mm. Not identified in America.

(?) Sp. 5. **Alonella grisea,** Fischer.

This species is included here on the authority of Kurz. The shell may or may not be toothed at the lower corner, and is partly lined and partly reticulate; but the only character which at all separates this species from the above seems to be the position and form of the head, which is said to be blunt and nearly horizontal, as in Camptocercus rectirostris. Is this a transition to Graptoleberis?

Sp. 6. **Alonella pygmæa,** Sars.

(Plate H Fig. 7.)

Alona pygmæa, SARS.
Pleuroxus transversus, SCHOEDLER.
Alona transversa, P. E. MUELLER.
Lynceus nanus, FRIC.
Alonella pygmæa, KURZ.

The form is rotund, much like species of Chydorus in the highly arched dorsal outline; the beak is rather short and depressed; the lower outline of the valves is very convex in front, and barely sinuate behind, where it terminates in a minute spine. The shell is marked, as in no other lynceid, by lines running diagonally backward, and only on the lower part reticulated, if at all.

The post-abdomen is short, broad and rounded below; the claw has a single basal spine. Length 0.20 mm.—0.28 mm. This is the smallest member of the Cladocera. In form it so nearly resembles Chydorus that upon first sight the writer took it for a member of that genus. Our one specimen measured 0.25 mm. The shell is marked by plications rather than striæ, which arch over the back.

Sp. 7. **Alonella straiat,** Schoedler.

This species is said to resemble A. exigua in habit and sculpture of shell; the form is quadrangular and not greatly elevated in the middle; the lower margin is nearly straight and fringed with bristles; the posterior angle is rounded and unarmed. The antennules with their setæ extend beyond the beak; the pigment fleck is smaller than the eye and half way to the beak. The post-abdomen is long and narrowed toward the end; there are seven or eight anal spines, and two spines on the terminal claw. Length about 0.5 mm.

SUB-GENUS PLEUROXUS.

Section A. *Pleuroxus* (*verus*), Baird.

This group of lynceids is most obviously defined by the long "beak", formed by the extension of the chitinous covering of the head. (There is rarely a beak in the sense of that word as applied in the case of Scapholeberis or Daphnia, but the antennules are simply attached to low prominences on the under side of a broad shield-like projection of the shell.) This beak-like projection is acute and often long and either curved backward or even bent forward. The fornices, or lateral projection of the head-shield, are narrow. The form varies much, but is almost always very strongly convex above, and the posterior margin is thus only a fraction of the whole hight of the animal. In some American species the body is very much elongate, and these also depart from the characteristic habitus of the genus in having strong longitudinal striæ instead of [illegible] tions. The lower posterior shell angle has teeth which, in [illegible] entire posterior margin. The post-abdomen is slender, usually truncate and armed behind with a single set of sharp teeth on either side; the terminal claw has usually two spines and may be serrate.

The male has a shorter beak, the post-abdomen is more or less modified, and the first foot has a powerful hook. The winter eggs frequently have a true ephippium; and sometimes this structure is like that of Chydorus, toward which the round forms of this genus seem to lead. There are upwards of a dozen valid species, several of which are American.

Key to Section A, Pleuroxus verus.

§ Beak not curved forward.

- A. Shell reticulate.
  - (a) Post-abdomen very narrow.
    - 1. *P. hastatus*, Sars.
    - 2. *P. stramineus*, Birge.
  - (b) Post-abdomen not very slender.
    - * Terminal claws with two spines.
      - 3. *P. trigonellus*, O. F. Mueller. (?)
      - ?. *P. ornatus*, Schœdler.
    - ** Terminal claws with a single spine.
      - 4. *P. acutirostris*, Birge.
- B. Shell smooth, except upon the front margin.
  - 5. *P. adunctus*, Jurine.
- C. Shell striped.
  - (a) Shell very long and low.
    - * With one tooth below.
      - 10. *P. unidens*, Birge.
    - ** Without a tooth ; female with a hook upon the first foot.
      - 8. *P. hamatus*, Birge.
    - *** Without a tooth on the shell or claw on the foot.
      - 9. *P. affinis*, Herrick.
  - (b) Shell high.
    - * Lower angle spined.
      - † Antennæ with eight setæ, anterior margin of valves toothed.
        - 7. *P. denticulatus*, Birge.
      - †† Antennæ with seven setæ.
        - 6. *P. bairdii*, Schoedler.
    - ** Whole posterior margin of shell spined (Percantha.)
      - 11. *P. truncata*, O. F. Mueller.

§§ Beak procurved (Rhypophilus.)

- A. Shell reticulate.
  - * Faintly and regularly.
    - 13. *P. glaber*, Schoedler.
  - ** Strongly and irregularly.

(Plate 1.

Pleuroxus lævis, SARS.
Pleuroxus hastatus, P. E. MUELLER.

Form somewhat oval, dorsal line strongly curved, posterior margin short, with a tooth below; head short, beak very long, straightish; shell obscurely reticulate. Post-abdomen very long, narrow, with small teeth; claw with two basal spines. Color corneous. The sculpture consists of faint reticulations. The ephippium forms a truncation of the upper part of the shell. Length 0.50—0.55 mm. The male has a shorter beak; the first foot has a weak hook, and the spermatozoa are spherical.

? Sp. 2. **Pleuroxus stramineus,** Birge.

This form is the American representative of the preceeding, if not identical with it. Birge mentions minute striæ in the meshes. P. stramineus is said to be lower than P. hastatus, while its beak is shorter. Undoubted specimens of P. denticulatus exhibit the same differences, an increase in the convexity of the shell accompanying an increase in the length of beak. The form of the abdomen appears nearly identical, if we compare P. E. Mueller's plate IV, fig. 18, with the outline given by Birge at plate II, fig. 11. The color in both is deep, especially during the period when the winter egg is forming. The direction of the reticulations is said to differ, but P. E. Mueller's figure does not furnish positive evidence of this. Length 0.6 mm.

Sp. 3. **Pleuroxus trigonellus**, O. F. Mueller.

Lynceus trigonellus, O. F. MUELLER, LIEVIN, LILLJEBORG, LEYDIG, FRIC.
Pleuroxus trigonellus, SCHOEDLER, P. E. MUELLER, KURZ.
? *Pleuroxus ornatus*, SCHOEDLER.

Dorsal line strongly arched; the beak rather long, straightish; pigment fleck smaller than the eye. Shell faintly reticulate, the markings consisting of transparent ridges. Post-abdomen widest

attenuated slightly toward the end, which is truncate;

one very small basal spine. The anal

margin of the post-abdomen has a series of small spines, and the lower shell-margin is hairy. The post-abdomen of the male is somewhat as in Crepidocercus, and densely hairy; the first foot has a moderate hook.

To judge from Kurz's statements, P. ornatus, Schoedler, is not specifically distinct. Not yet identified in America.

Sp. 4. **Pleuroxus acutirostris,** Birge.

This form, with Harporhynchus, imitates in some respects the Alonellæ, from which they differ in having the beak elongated and recurved. Birge's description does not state what the form of the fornices is, but he intimates that the general resemblances are with Pleuroxus. The general shape is as in P. hamatus.

"The post-abdomen is broad, compressed, truncated, with numerous fine caudal teeth. The terminal claws have only one basal spine." "The valves are reticulated as in P. [Alonella] insculptus, although not so plainly." Length 0.35 mm. Southampton, Mass.

Sp. 5. **Pleuroxus adunctus,** Jurine.

Monoculus adunctus, JURINE.
Pleuroxus adunctus, SCHOEDLER, P. E. MUELLER, KURZ.

Very like P. trigonellus, but with the back more strongly arched. The anterior part of the shell is striped. The beak is shorter than in P. trigonellus, but no other permanent differences are discoverable. The temptation to believe this a mere varietal form of P. trigonellus is great. Indeed, four species (the two here noted, P. bairdii and P. denticulatus, Birge,) are very nearly related. The ephippium, where known, is marked by minute punctation and a darker color.

Sp. 6. **Pleuroxus bairdii,** Schoedler.

Pleuroxus trigonellus, BAIRD.
Pleuroxus bairdii, KURZ.

This form, so far as can be gathered from Baird's brief description and figures, differs from the others in having the shell marked by straight parallel lines running diagonally backward and upward, and in lacking one of the terminal bristles on the 5-setose ramus of the antennæ. The first is a possible but unusual structure, while the second might result from an overlooking of the very small seta which fills this place in the other forms. Baird himself did not distinguish it from P. trigonellus.

This species is smaller than those of the preceding group and forms a transition to the two next to be described in the greater elongation of the shell, which is, however, higher and more strongly arched. The head and beak are much as in P. denticulatus. The lower margin is concave posterior to the middle and slightly convex at the posterior angle, which is unarmed. The lower margin is hairy. The markings are as in P. denticulatus, but, in addition, there is a set of horizontal striæ all over the shell. The post-abdomen is widest in the middle and almost exactly as in P. denticulatus. The first foot bears a claw such as ordiuarily distinguishes the males.

The only specimens which I have seen were from the Tennessee river, near Waterloo, and near Decatur, in Alabama. My notes contain no reference to the minute striations, which could perhaps be hardly seen with the instrument employed. The process of the labrum is long and rather acute, the beak moderate, and the pigment fleck very large. The markings on the anterior of the valves are irregular and are inter-connected by cross lines or anastomoses. Ova two. (The genus Anchistropus has a hook upon the first foot, but is like Chydorus.)

Sp. 9. **Pleuroxus affinis.** (Sp. n.)

(Plate H. Fig. 2.)

A small species with elongated shell and longitudinal striæ, forming a link between the preceding and the next, to which it is closely related. Shell broadest in front, upper contour nearly straight; anterior part of the lower margin evenly arched, posterior margin rather low. Head very short; beak very long, narrow and somewhat incurved; antennules and antennæ very small; eye evidently larger than the pigment fleck. The post-abdomen is as in P. denticulatus, or a little longer proportionately. The markings, so far as observed, consist of diagonal, faint, numerous and parallel lines posteriorly, and others springing from the anterior margin. There is no tooth behind; the teeth on the post-abdomen are small and not numerous. The upper margin of the shell is not sharp but rounded. Thus this pretty and unique form is clearly distinguished from all its allies althongh unfortunately only this very imperfect description and schematic figure can be given. Found in Weakly pond, Culbert county, near Florence, Alabama, where with an Alona, Chydorus sphæricus and Scapholeberis, it formed the cladoceran fauna of the pool.

Sp. 10. **Pleuroxus unidens,** Birge.

(Plate F. Fig. 15).

An extreme among these elongated species, the length of body falling little short of double the hight. The dorsal line is very flat and slightly but evenly arched; the lower margin is evenly convex

Lynceus truncatus, MUELLER, KOCH, ZADDACH, LIEVIN, FISCHER, LILLJEBORG, LEYDIG, FRIC.
Percantha truncata, BAIRD, SCHOEDLER, KURZ.
Pleuroxus truncatus, P. E. MUELLER.
Percantha brevirostris, SCHOEDLER.

This species is widely distributed in Europe, but is replaced in America by the following. The shell is high, the dorsal contour arched; beak rather long and straight; lower margin slightly convex, setose; posterior margin straight, armed with very strong teeth entirely across it; the anterior margin also is dentate, as in the next. The valves are covered with strong striæ, springing from the anterio-central part and radiating toward the free margins. The post-abdomen is of moderate size and in form much as in the next. The ephippium causes a considerably change in form and coloration. In the male the beak is shorter, and the abdomen has finer teeth. The first foot has an extraordinarily large hook. The length is about 0.5 mm. to 0.6 mm. Percantha brevirostris, Schoedler, differs in the length of the beak only.

Sp. 12. Pleuroxus procurvus, Birge.

(Plate E. Figs. 3, 4.)

In size and general appearance this most interesting species is similar to the above, and, especially, to P. denticulatus. The general form and even the details of structure agree almost to identify with the latter. The structure of the posterior margin is like Percantha, while the rostrum is bent abruptly upwards as in Rhypophilus. In small individuals the length is greater proportionally. The lower margin is slightly convex or nearly straight, and fringed by bristles which are stronlgy pectinate; the anterior and lower margins are toothed as in Percantha. The shell gland is more as in the Daphnidæ than most lynceids. The number of posterior teeth is variable. The ephippium is as in P. denticulatus. Length 0.40 mm. to 0.50 mm. Not rare, but less common than P. denticulatus. The male post-abdomen is like that of P. denticulatus; the rostrum is as in the female.

Of the species following it may suffice to say that they are corpulent, filth-loving representatives of P. trigonellus, P. adunctus and P. bairdii, respectively, which have turned up their noses at a superficial existence and buried themselves in the mire and debris at the bottom of the pools. It might be fanciful to assume that the curved snout is used for "rooting," but the fact that these "Schmutzpeterchen" lynceids would find a long straight beak in the way is suggestive.

Sp. 13. Pleuroxus *(Rypophilus)* glaber, Schoedler.

Pleuroxus personatus, P. E. MUELLER.

The shell is high and squarish, the fornices narrow, the beak slightly pro-curved, the lower margin nearly straight, with two or more teeth at the posterior angle. The antennæ have seven setæ only. The male is almost exactly as that of P. trigonellus. Length 0.55 mm. to 0.65 mm.; male 0.5 mm.

Sp. 14. Pleuroxus *(Rypophilus)* personatus, Leydig.

That this species is really distinct is by no means certain; however, it is stated that the shell is less regularly and more markedly reticulated, and the markings lack the elevations described under P. trigonollus, which are present in the previous species. It lives in filth and covers itself with it.

Sp. 15. **Pleuroxus** *(Rypophilus)* **uncinatus,** Baird.

The shell is ridged with lines running upward and backward, as in P. bairdii; the lower angle of the shell has three teeth, and the beak is more horizontal than in the above. In size and characters this is almost identical with P. bairdii, with which it occurs in England.

This completes the list of swine-like members of the genus; these well deserve to be studied from a morphological stand-point.

Pleroxus nasutus, Gay, is a poorly described form from Chili, resembling, according to Schoedler, P. ornatus = trigonellus.

A species of Percantha (Lynceus armatus, Gay) is found in Chili

NOTE TO PLEUROXUS.—The two species P. unidens and P. affinis are quite diverse from the type of the genus and approach in some respects to Leptorhynchus. P. affinis particularly, has a recurved beak. I am in doubt about P. hamatus and P. acutirostris, which is said to be reticulated; but it seems likely that the species above mentioned stand in closest relation to Leptorhynchus.

Section B. *Leptorhynchus*, Herrick.[1]

The species for which Sars formed the genus Harporhynchus is of Alona-like habit, but has a beak which exceeds that of any known Pleuroxus in length, being simulated in this respect by the American P. acutirostris, which is, however, in other respects more nearly allied to Pleuroxus.

Leptorhynchus falcatus, Sars.

Harporhynchus falcatus, SARS.
Alona falcata, SARS, P. E. MUELLER.

Body oblong, arched above; ventral margin nearly straight, setose with a spine at the posterior angle; beak strongly curved, folded laterally; pigment spot larger than the eye. The post-abdomen is wide, sides nearly parallel, armed with a few strong teeth below and a lateral line of spines; caudal claw with a single small basa spine.

VIII.—GENUS PHRIXURA, P. E. Mueller.

Oblong, wide; posterior shell-margin little less than whole hight Post-abdomen terete, obtuse at the end, which is armed with a cluster of spines of which the terminal ones are similar to the others

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[1] Harporhynchus is preoccupied in ornithology.

Sp. 1. **Phrixura rectirostris,** P. E. Mueller.

(Plate I. Fig. 18.)

Beak acute; shell striated longitudinally, slightly arched above; ventral margin rounded, with a round and unspined angle behind. Length 0.5 mm. Not yet encountered in Minnesota.

IX.—GENUS CHYDORUS, Leach.

This genus, if it be really of generic value, contains minute rotund animals which appear in the water like animate pin-heads of small size. Their motion is a rolling, wavering hobble; and they live by preference upon vegetation, or in slime at the bottom of pools. Occasionally they may be seen in sunshiny weather, disporting themselves near the surface in immense numbers. There are two common species, and six more which are more rare or in part not valid.

The sexual period occurs at two different periods (i. e., May—June, and December), but in probability is not confined to any periods. The males, which only rarely are found even in these periods, have the abdomen narrowed or excavated to accomodate it to the peculiar alteration of the brood-cavity which takes place in the sexually mature female. The connection takes place by the insertion of the abdomen within this chamber, which is facilitated by the reduced size of the abdomen. The modification of the shell of the brood-cavity above referred to consists in the thickening of the wall posteriorly, which may or may not result in the deforming of the shell, as shown in plate F, fig. 7, taken from Kurz. This may be termed an ephippium, although it differs somewhat from the modified shell so called in Daphnia. The male element consists of nearly round nucleated cells, and the opening of the vas deferens is anterior to the terminal claws. The members of this genus are among the most minute forms of the family or the entire group. Concisely put, the characters are as follows:

Form globose, not obviously truncate behind; head terminating in a sharp, long, curved beak, which lies close upon the anterior margins of the valves; antennæ short; eye larger than the pigment fleck; abdomen flattened, excavated in the male; intestine with nc anterior cæca, doubly convoluted, with an anal cæcum. Three species found in Minnesota.

Sp. 1. Chydorus

(Plate F. Figs. 4, 7, 8 and 10.)

Lynceus sphæricus, O. F. MUELLER, M. EDWARDS, KOCH, ZADDACH, LIEVEN, FISCHER LILLJEBORG, LEYDIG, TOTH, ZENKER, FRIC.
Monoculus sphæricus, JURINE.
Chydorus muelleri, LEACH.
Chydorus sphæricus, BAIRD, SCHOEDLER, P. E. MUELLER, LUTZ, KURZ, BIRGE.

Form nearly spherical, as seen from above broadly oval; in young specimens truncate behind; antennules of moderate size, in the male very large, with curved flagellum near the middle of anterior margin; pigment fleck often nearly as large as eye; beak of moderate length, blunt in the male; first foot strongly hooked in the male; post-abdomen short, broad, rounded at the end, armed with 8—9 sharp teeth; shell reticulated with polygonal meshes. Color light, unspotted. Length 0.50 mm.

This species occurs in Spring earlier than most forms, and is ranked as the most abundant of the micro-crustacea, being found over the whole circumpolar land-area. The ephippium for the winter egg was observed by Kurz, but the period at which it is formed seems variable.

C. sphæricus of a previous report seems to have been the following species which is more common in Minnesota in the clearer lakes. A small form in our large lakes measures 0.3 mm.; it may be distinct.

Sp. 2. Chydorus globosus, Baird.

(Plate F. Figs. 1, 2, 3 and 9.)

Chydorus globosus, BAIRD, LILLJEBORG, SCHOEDLER, LEYDIG, P. E. MUELLER, FRIC, KURZ, BIRGE.

Form globose, very broad; antennules very large with a strong lateral seta on a small elevation; swimming antennæ exceedingly small; the shell gland is well developed; the pigment fleck is much smaller than the eye; beak very long and incurved; post-abdomen rather long, more slender than the last, broader near the end which is truncate, bearing about 20 spines on the margin near which is a lateral series of minute bristles; the terminal claws are straightish, spined along the basal half, and have an accessory spine; the shell is very indistinctly reticulated and spotted; color dark; length 0.7-0.8 mm.; male 0.55 mm. The males have the abdomen very narrow for the entire length.

This species is considered rare elsewhere, but is not infrequent in August near Minneapolis.

Sp. 3. **Chydorus ovalis**, Kurz.

(Plate F. Fig. 11.)

Form oval, nearly twice as long as high; beak long; antennules two-thirds as long as the beak, with two elongated sensory filaments above the others; pigment fleck nearly as large as the eye; antennæ small; shell margins heavily fringed anteriorly; post-abdomen of moderate size, rounded at the end, with about 8 teeth near the end; shell smooth. Length 0.4 mm.

This species is rather near C. sphæricus, differing in having the shell smooth, antennæ shorter, and beak longer. This species is not yet known in America.

Sp. 4. **Chydorus cælatus**, Schoedler.

(Plate F. Fig. 12.)

Chydorus adunctus, SCHOEDLER.

This small species is about 0.4 mm. long, and resembles the young of C. globosus in form, from which as well as from all known species it is distinguished by the markings of the shell, which consist of series of rounded elevations (or depressions?) arranged parallel to the lower margins of the shell and head. The description is very incomplete, and the only other author who appears to have seen the animal is Kurz, who adds that the sensory filaments of the antennæ are unequal in hight, and that the so called elevations are really depressions. A form with a few depressions about the edge and characters of this species was once seen in the vicinity of Minneapolis.

Sp. 5. **Chydorus nitidus**, Schoedler.

(Plate F. Figs. 5, 6.)

Shell smooth and regularly punctate; the head resembles C. sphæricus, but the pigment fleck is much smaller than the eye, to which it is much nearer than to the end of the beak; the post-abdomen is broader near the end, and bears a row of 10—12 teeth on either side.

(?) Sp. 6. **Chydorus latus**, Sars.

Very possibly a variety of C. globosus, from which it differs in the shorter beak and greater size. Length 0.66 mm.

Sub-rotund, prominent above, sinuate behind; lower and posterior margins rounded, lower margin ciliated. Head movably united to the body; beak long, separated by an indentation from the head shield. The shell is broad, as seen from above. Shell punctate anteriorly and marked below by indistinct oblique striæ. Antennules with seven setæ and two small thorns on the end of each ramus. Post-abdomen truncate; the terminal claws with a minute tooth at the base; posterior margin sinuated, rounded below and there densely armed with minute teeth. Abdominal setæ long and flexible. Pigment fleck of medium size, much nearer to the eye than to the beak. Length about 0.33 mm.

(?) **Chydorus latifrons,** Dana. (U. S. Exploring Expedition, Rep. on Crust., vol. II, p. 1274.)

Very tumid; in side view rotund, head not separate, very short-beaked; beak slender and close to the body, acute; in upper view animal very broad, truncate anteriorly, the front thereby nearly as broad as the body; behind low, triangular and obtuse. Feejee islands.

(?) **Chydorus albicans,** Gay,

from Chili, is imperfectly described; but it is interesting to note the occurrence of this genus there.

X.—GENUS ANCHISTROPUS, Sars, (?)

Very similar in form to Chydorus; valves gaping below anteriorly; antennules small; process of labrum rounded. Post-abdomen attenuated toward the end, densely covered with fine teeth; terminal claws denticulate. First foot with a powerful claw, protruding beyond the shell. Eye very large. Shell indistinctly reticulate. Sars says of his Anchistropus emarginatus that on cursory inspection it would be taken for the young of Chydorus globosus. He found but few specimens, about 0.35 mm. long. The suggestion is still possible that the young males of some Chydorus are here mistaken for a new genus. The males of Chydorus globosus were not known till 1878, and their early form is still unknown. The young females have a tolerably strong claw, though it is not much curved. I have once found a peculiar lynceid measuring 0.46 mm., with unevenly but distinctly reticulate shell, slender abdomen, and a strong claw which was dentate. There were several young (more than two), and the shell in these was more regularly reticulate. All efforts to find a second specimen failed, and the one seen was somewhat mutilated; hence I am unable to determine its real position.

XI.—Genus Monospilus, Sars.

Head separated by a depression from the body; shell high, compressed, posterior margin somewhat less than the greatest hight of the shell. Post-abdomen broad, ornamented with lateral and posterior spines; claws large, with a single basal tooth. The compound eye is absent, its place being taken by the pigment fleck, which is the functional eye.[1]

Monospilus dispar, Sars.

(Plate I. Fig. 21.)

Lynceus tenuirostris, FISCHER, Abh. ueber einige neue Daph. und Lynceidæ. p. 427, tab. III, figs. 9—10 (*fide Sars*).
Monospilus dispar, SARS, Crust. Cladoc. i Omgn. af Christiania, p. 165.
Monospilus dispar, MUELLER, Danmark's Clad., p. 196.

Shell roundish; ventral margin setose; posterior angle rounded, marked above with numerous impressions. Antennules small; antennæ long, with seven setæ. Post-abdomen short and broad, bearing a series of spines along the excavated posterior margin, and ornamented on the sides with clusters of bristles. The shell in old individuals is not moulted but remains as in Ilyocryptus, covering the greater part of the new shell. The figure shows an old individual with its successive coverings still clinging to it. Like Ilyocryptus, this animal passes its life in filth at the bottom of pools, and rarely emerges to the light of day. What little visual function there may be is vested in the larval organ.

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[1] So much interest attaches to this species that we reproduce the Latin description of Sars. " Testa in adultibus valvulis composita pluribus, altera alteri imposita, a latere visa lata, latitudine maxima in parte antica sita; margine superiore antice valde prominente, posteriore et inferiore ciliato rotundatis. Caput mobile, perparvum et valde depressum, supine impressione parva sed distincta, a testa cetera disjunctum, deorsum in rostrum rectum et breve apice obtuso exiens. Animal supra visum sat compressum, latitudine maxima capite majore ante medium sita. Pars superior testæ et capitis impressionibus numerosis rotundatis notata. Antennæ 1-mi paris minutæ structura ut in ceteris Lynceidis; 2-di paris sat longæ, ramo altero setas 4 et aculeum unum apicalem, altero setas 3 et aculeos duos, quorum alter longus articulo primo ejusdem rami adfixus est, gerunte. Postabdomen breve et latum, apicem versus truncatum; margine posteriore supra obtuse angulato, ad angulum inferiorem rotundatum seriebus duabus aculeorum inque lateribus setis vel spinulis brevibus numerosis præditum; ungues terminales ad basin aculeo longo armati. Intestinum, ut in ceteris Lynceidis, in thorace laquem fere duplicem format. Macula nigra unica minima prope basin antennarum 2-di paris; maculæ infra oculari in ceteris Lynceidis simillima, in capite conspicitur, quæ, quum oculus verus compositus in omnibus ceteris Crustaceis Cladodoceris distinctus omnino absit, organum quamquam rudimentare visus habenda est. Animal parum pellucidum, colore fulvescente. Longit. parum supra ⅓ mm "

The specimen from which the drawing was made measured 0.45 mm. The first glance at this rarest of all entomostraca affords proof of its unique character. The strongly arched shell is so compressed as to bear little resemblance to Chydorus. The dorsal line passes with little angle into the high posterior margin. There is a rounded angle below, armed with two teeth—the shortened representatives of the fringing spines of the straight lower margin. The head is depressed and very short, but the narrow beak is produced to below the margin of the valves. It is rounded so as to resemble, as seen in front, a duck's bill. The fornices are narrow and flare so that the eye is left partly exposed upon the side. The antennules are not long but slender. The labrum has a very large lamella, which is crenulate in front and acute below, the labrum proper being large. The systematic position of this genus is a matter of considerable interest, for it is the only member of the whole order in which the larval eye is the only one developed, and the first thought would be that this must be a primitive synthetic type, in other words, historically the oldest of Cladocera. Closer study does not warrant the theory. There is much to indicate that, though essentially lynceid, it stands in close connection with the higher members of the family and perhaps has more than a superficial resemblance to such degraded lyncodaphnids as Ilyocryptus. All things considered, however, our diagram stands with this genus as a degraded offshoot of the more typical stem of Lynceidæ.

SUB-ORDER II.—GYMNOMERA.

This group is easily recognized by the almost entire absence of the shell, which forms so conspicuous a part in the greater number of the Cladocera. Here it serves simply to form a pouch or brood-sac for carrying the eggs and embryos. The feet are nearly terete and prehensile, with but slight indications of branchial appendages.

FAMILY POLYPHEMIDÆ.

Feet five pairs. Antennæ with the rami three- or four-jointed.

I.—Genus Polyphemus, De Geer.

Head very large, separated by a depression from the compact body; shell covering but a part of the dorsal region. Feet all with an internal dentate, and an external lamellate appendage. Caudal seta upon a long process of the post-abdomen.

Sp. 1. Polyphemus pediculus, Linn.

(Plate B^1. Figs. 4—6.)

Monoculus pediculus, LINNÆUS, 1746. GMELIN, Linn. Syst Nat. FABRICIUS, Ent. Syst., etc. SULZER, Insecten. MANUEL, Encyclop. Meth.
Monoculus pediculus ramosus, DE GEER, Mem. pour serv. a l'Hist. des Ins.
Polyphemus oculus, MUELLER, Zool. Dan. Prod. et Entomost. CUVIER, Tab. element LATREILLE, Hist. Nat. Crust., etc. LEACH, Edin. Encyc.
Polyphemus stagnorum, LEACH, Dict. Sc. Nat. LATREILLE, Cuv. Rig. An. DEMAREST, Cons. Gen. Crust.
Polyphemus pediculus, STRAUS, Mem. Mus. d'Hist., etc. M. EDWARDS, Hist. Nat. Crust.
Monoculus polyphemus, JURINE, Hist. Nat. Monoc.
Cephaloculus stagnorum, LAMARCK, Hist. An. Vert. BOSC, Man. d'Hist. Nat. Crust.
Monoculus oculus, GMELIN, Linn. Syst. Nat.
Scalicerus pediculus, KOCH, Deutsch. Crust.
Polyphemus pediculus, BAIRD, Brit. Entom.
Polyphemus oculus, LIRVIN, Branch. d. Danz.
Polyphemus stagnorum, FISCHER, Ueber die in d. Umg. von St. Petersburg, vorkom. Crust.
Polyphemus pediculus, LILLJEBORG, De Crust. ex ord. trib.
Polyphemus oculus, LEYDIG, Naturg. d. Daph.
Polyphemus pediculus, SCHOEDLER, Neue Beitr. zur Naturg. d. Cladoceren.
Polyphemus kochii, " " " "
Polyphemus oculus, " " " "
Polyphemus pediculus, P. E. MUELLER, Danmark's Cladocera. KURZ, Dodekas neuer Cladoceren. WEISMANN, Beitr. zur Naturg. der Daphnoiden. BIRGE, Notes on Cladocera.
Polyphemus occidentalis,[1] HERRICK.

There are two well-marked varieties of this species: one is found commonly in the clear lakes; the other, which I have only once seen, was found in a very shallow weedy marsh. The difference in size is quite remarkable. Our ordinary form measures less than 1 mm. The larger form, including the stylets, is 1.6 mm. The ordinary variety, although highly colored, is yet transparent, while the large variety is deep red and quite opaque. The relationship between the two forms is quite like that maintaining between Diaptomus stagnalis and D. sanguineus. Some slight structural differences are observable between the two varieties, as in the form of the antennules, yet quite insignificant when compared with the striking difference in size and coloration. Number two may be called

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[1] Polyphemus occidentalis, Dekay → Limulus.

In order to make the relation clear between these forms, I add measurements of this species, following each with the corresponding measurement of P. pediculus in parenthesis; animals of the same age, as far as possible, being chosen. Head (capsule of eye) 0.3 mm. (0.2 mm.); head and thorax 0.7 mm. (0.45 mm.); abdomen 0.7 mm. (0.56 mm.); caudal stylet 0.36 mm. (0 26 mm.); caudal filaments 0.36 mm. (0.3 mm.). Whole length of antennæ 0.54 mm. (0.42 mm.); first, second and third joints of the 3-jointed ramus 0.08, 0.06 and 0.10 mm., respectively. The formation of the resting eggs or "dauer-ei" seems to go on at the same time with the parthenogenetic reproduction.

II.—GENUS BYTHOTREPHES, Leydig.

Much like Polyphemus, but the external appendage of the feet is rudimentary, and the abdomen extends out into a most enormous spine. The single species is that described by Leydig as B. longimanus, which was found in the stomach of Coregonus wartmanni. B. cederstromii, of Schoedler and P. E. Mueller, the latter author now identifies with the above, and concludes that the supposed differences arose from "l'etat de maceration des examplaires examines." *(Les Cladoceres des Grands Lacs de la Suisse*, p. 11.) This species may be looked for in the depths of the Great Lakes. (See plate U, fig. 10.)

III.—GENUS PODON.

IV.—GENUS EVADNE.

These are compact oval forms confined to the sea. See Claus, *Zur Kenntniss des Baues der Polyphemiden*, Vienna, 1877, for the best account of the anatomy.

FAMILY LEPTODORIDÆ.

Feet six pairs. Antennæ with both rami four-jointed. Body elongated, not curved, shell very much reduced.

Leptodora hyalina, Lilljeborg,

(Plate N. Figs. 6, 7),

the only species, is found rarely in the larger lakes of Europe and America.

See *Bau und Lebenserscheinung von Leptodora hyalina*, Weismann, 1874; also, *Om en dimorph Udvikling samt Generationsvexel hos Leptodora*, G. O. Sars, 1873; also, *Bidrag til Cladocerenes Forplantningshistorie*, P. E. Mueller.

The work of Sars is particularly valuable, showing that the young produced from the winter eggs pass through a metamorphosis not experienced by the summer or parthenogenetic brood. P. E. Mueller mentions the pathological condition induced by the plants of the Saprolegnia.

CHAPTER III.

ORDER COPEPODA.

This extensive order contains minute and predominatingly predaceous animals which constitute no inconsiderable part of the fauna of fresh and salt waters. They serve a beneficent purpose both as scavengers and as providing food-supply for the fry of fishes and other aquatic animals.

Copepods are never enclosed in a bivalved shell but ordinarily exhibit a more or less elongated cylindrical form composed of two obvious sub-divisions. There are a few species which, by the great prolongation and expansion of some of the tergites or dorsal shields, seem to simulate shelled crustacea. The anterior part of the body, or cephalothorax, is composed of ten somites which are frequently considerably united or fused. Five of these segments constitute the head and bear respectively the following appendages: first, a pair of several- to many-jointed antennæ which are never primarily sensory in function, although they usually are provided with sense hairs or other like organs; second, a pair of two-branched antennules, which sometimes become almost simple or prehensile; third, a pair of mandibles in the form of masticatory or piercing organs, these being usually provided with a palpus; fourth, a pair of maxillæ of various form and function; fifth, a pair of maxillipeds which not infrequently subdivide in later life to form what appear to be two distinct pairs.

The five thoracic segments have each a pair of swimming feet consisting typically of a two-jointed base and two like, three-jointed rami. The symmetry is frequently broken by the retardation of the development of the inner ramus, while the fifth pair of feet may become rudimentary and in various ways subserve the organs of sex. The five abdominal segments are nearly devoid of appendages and are continued posteriorly by two caudal stylets which bear strong setæ constituting, in many forms, a tail-fin or spring.

All copepods, even such as are, in later life, parasitic, begin their existence as free-swiming nauplii, such as are represented on plate S, fig. 13, and plate K, fig. 8.

Though the vast majority of genera and species are marine, it would seem that fresh-water copepods make up in the number of individuals what they lack in variety.

As we are dealing primarily with the fresh-water species, no lengthy description of the group is here necessary.

The earlier history of our knowledge of the animals of this order is given by Baird. According to this authority, the first to mention any fresh-water species of this group was *Stephan Blankaart*[1] in his *Schou-burg der Rupsen, Wormen, Ma'den, en vliegende Diekens tot Amsterdam*. *Leeuwenhoek* adds numerous interesting details and is accredited by Hoek with being to first to discover the relation between the remarkably diverse stages which occur in the history of the cyclops. However, it is evident that he had a very incomplete knowledge of the metamophoses.

De Geer gives rather characteristic figures of a cyclops in *Memoires pour servir a l'Histoire des Insectes*, vol. vii, 1778.

Mueller, in his great work on *Entomostraca*, adds new facts, defines species and forms the genus Cyclops.

Ramdohr in 1805 gave sundry additions to the knowledge of these animals in his *Beitraege zur Naturgeschichte einiger Deutschen Monoculus-arten*. In this work the post-embryonic history is quite fully outlined.

Jurine, in his classic work *Histoire des Monocles qui se trouvent aux Envirous de Geneve*, 1820, crystallized what previous authors as well as his own original experiments had brought to light of the anatomy and biology of these animals.

Ferussac (Memoire sur deux novelles espices d'Entomostraces) redescribes known species.

Gunner, *Stroem*, and *Viviana*, seem to have had little effect on the knowledge of the group, though they wrote prior to Jurine.

A recent author attempts to revive the names of Jurine, though hitherto it has been thought hazardous to attempt a specific identification.

The German author, *C. L. Koch*, who only incidentally studied this group, distinguished more or less perfectly, a variety of species which have been reinstated in our literature by Rehberg. Although this proceeding seems quite unjust to the careful authors whose descriptions are recognizable in themselves, the law of priority must probably prevail. Koch's *Deutschlands Krustaceen* appeared in 1838.

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[1] Latinized *Stephanus Blanchardus*. Hoek recognized Cyclops brevicaudatus or C. bicuspidatus as the one described, chiefly through knowledge of the present inhabitants of the locality.

Baird's British Entomostraca, without greatly extending our knowledge of this order, put in readable form and made available to English readers what was known, and added interesting facts. He distinguished two families of Copepoda, (1.) Cyclopidæ, (2.) Diaptomidæ. The first included the genera (1.) Cyclops, (2.) Canthocamptus, (3.) Arpacticus, (4.) Alteutha; and the second the general (1.) Diaptomus, (2.) Temora, (3.) Anomlocera.

Fischer, who contributed not a little to our knowledge of the distribution of fresh-water Cladocera, was the next to describe valid species. He described the species found near Moscow and St. Petersburg, Russia.

Ouchakoff is likewise a Russian author, but his writings are quite unknown to me.

The justly famous Swedish naturalist, *W. Lilljeborg*, who has left his mark on so many branches of natural science, has not neglected the microscopic crustacea of his fatherland. *Om de inom Skaane foerekommande Crustaceer af ordningarne Cladocera, Ostracoda och Copepoda* is the somewhat formidable title of his work, published in 1855. He recognized the following genera of Copepoda: Diaptomus, Temora, Dias, Ichtyophorba, Tisbe, Tachidius, Harpacticus, Canthocamptus, and Cyclops. A species each of Diaptomus and Canthocamptus is described, and two species of Cyclops. (It would seem from authors' quotations that other species are described in an appendix, but the copy I have seen lacks this.) The author who has done most for micro-carcinology in general is *Carl Claus*, of Vienna. His principal works are:

1. "Das Genus Cyclops," etc. In *Wiegmann's Archiv fuer Naturgeschichte.* 1857.
2. "Weitere Mittheilungen ueber die einheimischen Cyclopiden." The same, 1857.
3. *Die Freilebenden Copepoden,* 1863.

The later work especially is indispensable to the student of Copepoda, though in reality it is more important in respect to marine Copepoda.

In the meantime a work appeared in Norwegian, with Latin descriptions, from the pen of *G. O. Sars.* This has been largely overlooked. It is, unfortunately, unaccompanied by plates, but the descriptions bear the stamp of the naturalist

A little later a second brief contribution from this author was published, but I have not seen it.

Sir John Lubbock in 1863 describes species of fresh-water copepods, but the publication seems no longer necessary.

Heller, in Tyrol, *Fric*, in Bohemia, and *Uljanin*, in Asia, have studied the copepod fauna.

A Russian paper by *Poggenpol* and *Uljanin* is quoted as "A Catalogue of the Copepoda, Cladocera and Ostracoda of the vicinity of Moscow," by Rehberg, and as from the *Protokolle der kais.-naturw. anthropol. und ethnogr. Ges. in Moskau*, but by Cragin who publishes a translation apparently of the same paper, in part, as from the "Bulletin of the Friends of Natural History."

Hoek, in the *Tijdschrift der Nederlandsche Dierkundige Vereeniging* (Magazine of the Zoological Society of the Netherlands) 1875, and later in German in the *Niederlaendisches Archiv fuer Zoologie*, gave excellent figures and descriptions of some species which Claus had too hastily treated.

In 1878 *A. Gruber* gave descriptions of "Two fresh-water Calanidæ."

In the same year the first volume of *Brady's* fine "*British Copeoda*" appeared. A purely technical work and briefly written, it is yet very comprehensive and in the main reliable. This is a worthy successor of the Ray Society's earliest publication on entomostraca —Baird's great work.

In the sixth vol. of the *Abhandlungen d. naturwissenschaftlichen Vereine zu Bremen*, Herman Rehberg gives a systematic review of synonomy, and in the revision unites several species in a manner that the present writer had independently been driven to do. It is probably impossible either to substantiate or positively deny some of this writer's identifications of the species of the older authors.

This paper also contains an observation of a hermaphroditic cyclops, which it is interesting to compare with similar anomalies, described by Kurz in Cladocera.

In the vii Band of the same periodical, Rehberg adds to and modifies some of the views expressed above. In the same number is a description of a new species of Temora by *Poppe*. (The same species occurs in the semi-saline waters of the Gulf of Mexico, and had well-nigh gone into print under a new name when this was seen.)

In the above review we have noticed only the more important foreign works on the Copepoda and those including fresh-water forms. *Dana's* magnificent *Crustacea of the Wilkes' Exploring* by Forbes and published about simultaneously.

Several articles in the *Naturalist* bring the bibliography up to May, 1883, when *F. W. Cragin* published in the *Trans. Kansas Academy of Science*, "A Contribution to the History of the Fresh-water Copepoda." In this paper ten species of Cyclops are described or mentioned. The author ignored previous American literature and thus adds somewhat to synonomy. The plates are lithographic, and are carefully, if not artistically, prepared. A valuable feature is the translation of the descriptions of Poggenpol's species from the Russian.

These papers, together with the outline presented beyond, it is hoped, will form a basis for future work.

Since writing the above, it is brought to my notice that in April, 1881, *V. T. Chambers* gave some account of a species of the Harpacticidæ referred by him to Tachidius. This species is particularly interesting on account of its novel habitat. Tachidius (?) fonticola, Cham., is found in the saline waters of Big Bone Springs, Ky., and thus is very distant from any marine congeners. It is perhaps doubtful if the generic reference can be sustained, but the species is worthy of further study. The Diaptomus described by the same author is hardly recognizable.

FAMILY CALANIDÆ.

This group is pre-eminently marine and contains diverse and graceful forms mostly with very elongated bodies and antennæ. Of the six genera here enumerated as more or less habituated to the use of fresh water, two are found as yet only in America and one is confined to Europe.

Heterocope, namely, is very near Epischura, both being restricted to fresh water. Diaptomus and Osphranticum are likewise only accidentally found in the seas, though their nearest allies are marine. The genus Limnocalanus is as yet found in America only in the Great Lakes.

In the distribution of genera we here follow Brady, whose definition of the family Calanidæ, including Calanidæ and Pontellidæ of authors, we quote: " Body elongated; composed of from ten to twelve [obvious] segments. Abdomen nearly cylindrical, much narrower than the cephalothorax and prolonged at the posterior extremity into two more or less cylindrical caudal branches [stylets]. First segment of thorax often anchylosed with the head; fourth and fifth segments also often coalescent. Head only rarely divided into two segments. Anterior antennæ very long and composed of twenty-four or twenty-five joints; that of the right side in the male often modified for grasping [geniculate]. Posterior antennæ large, composed of a basal joint, from which spring usually two branches, the primary branch consisting of two, the secondary of several joints. Mandibles strongly toothed at the apex, palp (usually) two-branched. Maxillæ strong, and provided with a many-lobed palp. Foot-jaws strongly developed: first pair very broad; the basal joints having on the inner margin wart-like processes, from which spring long ciliated bristles; the distal extremity divided into three short joints which are thickly beset with strong

Undoubtedly the most remarkable of fresh water copepods are the two American species of this genus. It is not yet certain that the second species may not be a young stage of the first but it seems quite improbable.

Related with Heterocope, Sars. The antennæ are 25-jointed, the right of the male being geniculate. The thorax is 6-jointed, the last two segments being partially coalesced. The abdomen is five-jointed in the male and four-jointed in the female, one branched, in the male modified for prehension. Abdomen of male with a

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*Heterocope is said by Patten (Cragen) to be common at Watertown, Conn.

prehensile appendage on the left side, often more or less distorted. Inner rami of swimming feet one-jointed. Caudal stylets with three long setæ. The first mention of an animal of this genus seems to be Pickering's description of Scopiphora vagans from deep water in lake Ontario. It seems almost certain that the species so imperfectly described in Dekay's Crustacea of New York, is none other than a species of Epischura, but I hesitate to substitute for a name accompanied by good descriptions and figures, and one which has already been incorporated, to some extent, into our literature, one which is founded on a description so imperfect and general that one incidental character alone enables one to guess its application. The following is Pickering's description:

"Body small, eye single, near the anterior margin of the shield. Antennæ large, and as long as in the preceding genus [Cyclops], and has the same motions in the water. Abdomen terminating in two styles, each with three setæ; last or three last joints. Ovaries none; legs spiny."

What is meant by the "brush" fails to appear, unless the specimens were ornamented with some parasitic plants or animals. The three setæ of the caudal stylets and long antennæ will place this form in no American genus save Epischura. But even this statement of Pickering may be held doubtful.

Sp. 1. Epischura lacustris, Forbes.

(Plate Q. Fig. 15.)

"The scond segment of the abdomen of the male is twice as long as the first, and produced to the right as a large, elongate, triangular process, somewhat hooked backwards at the tip. The third segment is similarly produced, but rounded and expanded at the tip, which is roughened before and behind.

From the right side of the fourth segment arises a stout process bearing at its apex a hatchet-shaped plate with seven broad obtuse serratures on its anterior margin. This process is roughened behind, where it is opposed to the concave side of the left ramus of the furca. From the same side of the fifth segment, a short flattened plate, of a spatulate or paddle-like form, extends forward above or beyond the toothed process just mentioned.

The antennæ are 25-jointed, and reach to the second segment of the abdomen. There are especially prominent sensory hairs on the first and third joints, borne at the tips of long spines. The antennules are short, the ramus apparently but three-jointed, the short, median joints common in this appendage being only obscurely indicated. The mandible has but seven teeth, the first simple and acute, separated from the second by an interval about equal to the second and third, the second to the sixth bifid, the seventh entire and acute. The usual plumose bristle is replaced by a sharp, simple spine.

The outer ramus of the fourth pair of legs has two teeth at the outer tip of each of the two basal joints. The terminal joint of this ramus is armed as follows: a short simple spine at middle of outer margin and another at the distal outer angle; a single and long terminal seta, strongly and sharply toothed externally and plumose within, and four long plumose setæ attached to the inner margin.

The left leg of the fifth pair in the male, viewed from behind, has the basal joint very large, broader than long, with the inner inferior angle produced downwards as a long, stout, curved process or arm as long as the two remaining joints. The second joint is trapezoidal, shortest within. The third joint is about half as wide at base as the first, is straight without, with a sharp, small tooth at its distal third, and bifid at tip. On the inner margin this joint is at first dilated a little, and then deeply excavated to the narrow tip, to receive the lower end of the left leg, the lower two-thirds of this margin forming the segment of a circle.

The right leg is two-jointed, the first joint twice as broad, enlarged at the lower end, forming an auriculate expansion at its inner inferior angle. The second joint is conical in outline and about two-thirds as long as the first.

The terminal bristles of the rami are very broad and strong in the female, the outer one especially having an extraordinary size and thickness. There is also at the outer angle of each ramus a short, stout spine, that on the left ramus being inflated like the outer bristle. Length .065 in.

The legs of the fifth pair in the female are three-jointed and similar, the basal joint short and broad, the second two and one-half times as long as wide. The leg terminates by four diverging teeth, preceded by two others, one on each side.

Taken in the towing net abundantly in October, 1881, at Grand Traverse bay; also obtained rarely by Mr. B. W. Thomas, from the city water of Chicago."

Occurring in Minnesota, probably in lake Superior.

Sp. 2. Epischura fluviatilis, Herrick.

(Plate Q. Figs. 14 and 16.)

Similar to the above but smaller (.04 in.) The females are very similar, though the fifth feet are more elongate and differently spined. The abdomen is perfectly straight and the three caudal setæ are of nearly equal size. The claw is armed with eight teeth, all but the first of which are emarginate. The abdomen of the male is straight, but has a strong process on the left side which bears a movable claw laterally and a small second segment which terminates in two small spines. The fifth foot of the male is peculiar; the inner ramus (or the left foot) lamelliform, one-jointed, with two opposable claws; the right branch is simple and 3-jointed, in form like that of the female. Here we have the most marked difference between the two species. Found in Mulberry creek, Cullman county, Alabama. Although a considerable number were examined no oviferous females were found, while the males contained the spermatophores and can hardly be thought immature, and, as it is in the male that the most marked differences appear, the two species seem certainly distinct.

III.—GENUS TEMORA, Baird.

(Plate H. Figs. 8—16.)

This genus contains several marine forms and two which are found also in streams opening into the sea. The species seem to be as follows: *T. velox*, Lilljeborg, *T. longicornis,* Mueller, (=*T. finmarchia*, Baird, =*Diaptomus longicaudatus*, Lubbock), *T. armata*, Claus, *T. inermis*, Boeck, and *T. affinis*, Poppe. T. clausii, Hoeck, is said by Poppe to be certainly identical with T. velox. Hoeck's figures are incomparably better than any of the preceding, but he seems to have been misled by errors in Lilljeborg. The species described by me before the Academy of Sciences of Minnesota (but still unpublished) as T. gracilis, from the brackish waters bordering the gulf of Mexico, agrees very closely with T. affinis, Poppe. (Abhandlungen v. naturw, Vereine z. Bremen, 1880, p. 55.) This name must therefore take precedence. This species has been found in the Rhine and rivers flowing into the gulf of Mexico, as well as in the marine or brackish waters into which these rivers flow. The occurrence of the genus in American fresh waters, justifies its mention here.

First reported as Potamoichetor before the Minnesota Academy of Sciences in 1879, but owing to a disastrous fire, publication was prevented. Priority probably belongs to Forbes' name, since, although first printed in the tenth annual of this survey, the edition was not distributed till after the August issue of the American Naturalist of 1882, containing the description above alluded to. Forbes says this genus has antennæ 23-jointed; all the specimens we have gathered from Minnesota to Alabama had 24-jointed antennæ. The original description of "Potamoichetor" is appended.

"Cephalothorax six-jointed, distal segments evident; abdomen, in the male, five-jointed, in the female four-jointed; antennæ twenty-four-jointed, the right geniculated as in Centropages (= Ichthyophorbia); first pair of feet with the rami both three-jointed, like the following; feet of the fifth pair, in the female, like the preceding, but with a spine of the joint preceding the terminal one enlarged and divaricated somewhat as in Centropages; in the male, the right with a two-jointed outer ramus, the terminal joint of which is spined and bears near its base a blunt expansion of its inner margin; outer ramus of left foot three-jointed, armed with unequal spines; inner branches smaller, similar, three-jointed; the terminal joint bearing curved spines; ovary and testes as in Diaptomus, with which the mouth parts agree in the main; eyes median, confluent."

Our own experience is that the single species of this genus prefers estuaries of running water. Forbes, however, has taken it from swamps and wayside pools.

Sp. 1. **Osphranticum labronectum,** Forbes.

(Plate Q2. Figs. 1—8 and 13—14.)

Potamoichetor fucosus, HERRICK, Cyclopidæ of Minnesota, etc., p. 224.

"Rather slender, and in size, as well as general appearance, resembling the smaller forms of Diaptomus; antennæ rather stout, reaching but little beyond the feet, appendaged as in Diaptomus, in the male strongly geniculated, but somewhat variously so; the six joints preceding the terminal four are thickened; those preceding the joint or hinge are arcuate on the distal margins; the secondary antennæ are about as in Diaptomus; mandibular palp two-branched, the outer three-jointed, the inner two-jointed; the terminal joint of the shorter branch bearing seven setæ, of the other four, the proximal joint of the former with three stout spines; the maxillæ nearly like Diaptomus; the processes have respectively the following numbers of setæ: the basal plate eight, the small processes at base of posterior branchial appendage one, the appendage itself twelve, terminal portion three groups, first containing nine, the second three, and the third four or five, the upper of the anterior processes two, and the lower three; fifth feet nearly like the others in size; the right in the male having the outer branch but two-jointed by the coalescence of the two outer to form an arcuate and deformed appendage, armed at the end with three stout equal spines; corresponding branch of left foot three-jointed; the terminal joint bearing three unequal spines, each of the preceding joints only one; inner branches similar, three-jointed; terminal joint being short and armed with three short lanceolate setæ and three longer ones, two of which are curved so as to be slightly prehensile; fifth foot of female with both rami three-jointed; inner ramus much smaller; antepenult segment of the outer ramus extending into a large lanceolate process; ova-sac long-ellipsoidal or spherical, reaching nearly to the end of the caudal setæ."

V.—GENUS DIAPTOMUS, Westwood.

The most widely distributed and well-known of fresh water Calanidæ, inhabiting in various species the smallest as well as the largest bodies of standing or sluggishly-flowing fresh water. Apparently a recently formed group whose nearest known ally is the curious Pseudo-diaptomus, found in the gulf of Mexico. The animals of this genus are apparently very susceptible to the influences of the environment, and are consequently extremely variable not only in color but in minor structural points. In America there is a curious fact, which is susceptible of different explanations, one of which was given in the American Naturalist at various times during the year past. The species or varieties fall in pairs, one of which is smaller and less highly differentiated, while the other is greatly enlarged and has the peculiarities emphasized. These sets occur in open and shallow water respectively. The large varieties are, as the rule, restricted to such shallow weedy pools as dry up during summer and freeze solid in winter. The forms intermingle slightly, but there are seasonal differences of greater or less extent.

The body is composed of an elongated thorax, with which the head is united, forming a six-jointed cephalothorax. The abdomen

h in the female these joints are so united as to
to appear three-jointed. The antennæ are
and the right male limb is modified by a coal-
ie terminal joints, a thickening of others and
certain spines, hooks, and knife-like ridges to
organ. The first pair of feet has two-jointed
remainder have both rami three-jointed, save the
foot is differently formed in the sexes, the inner
h foot being one or two-jointed. Terminal joint of
of this limb in the female very small or apparently
int produced to form a stout curved claw. The left
the male, serving, in some species, to affix the sper-
ie body of the female, while the abdomen is held by
The last segment of the thorax has one or two sharp
The spermatophore, or sperm case, is a long tube
ng expansive lining, which forces out its contents on
e water. The colors are frequently brilliant.

ur species of this genus are known in Europe, the
aptomus castor which seems universally distributed.
be doubted that the six forms mentioned below belong
arieties of this species; yet these forms can be disting-
well, and are deserving of distinct names. Two other
arest D. gracilis of Sars, but sufficiently distinct. These
d as do the pairs of the other section, and can not be
inguished.

wing is the most convenient arrangement of the genus
ı able to devise.

KEY TO THE GENUS DIAPTOMUS.

obust; right antenna of the male with a hook, much
anterior to the geniculating joint.

t greatly dilated.

ient of thorax prolonged into a sharp-spined angle or tooth.

one tooth (?).

astor, Jurine.

o teeth.

nder 3 mm.

ni of fifth feet in the female 1-jointed.

anguineus. Forbes.

5. *D. stagnalis*, Forbes.

** Last segment of the thorax more or less united with the previous one, bearing very small spines.

6. *D. longicornis*, Herrick.

(a) Length under 2 mm.

var. leptopus, Forbes.

(b) Length over 2 mm.

var. similis, Herrick.

B. Head enlarged.

7. *D. laticeps*, Sars.

II. Form slender, elongate; head divided into two portions; antennæ long, slightly altered in the male.

A. Antenna of male with a hook.

8. *D. gracilis*, Sars.

B. Antenna of male without a hook.

9. *D. pallidus*, Herrick.

(a) Antennæ much longer than the body, inner rami of fifth pair of feet in the male 1-jointed.

var. pallidus, Herrick.

(b) Antennæ little longer than the body, inner ramus of fifth feet bi-articulate.

var. sicilis, Forbes.

Sp. 1. **Diaptomus castor,** Jurine. [Sars.]

"Corporis forma sat robusta. Cephalothorax in femina postice parum antice vero magis attenuatus, angulis laminarum segmenti ultimi obtusis. Segmentum 1-mum abdominale absque mucrone laterali. Rami caudales brevissimi segmento antecedente vix longiores setis crassis et brevibus. Antennæ 1-mi paris mediocris longitudinis reflexæ segmentum 3-tium abdominale vix superantes, animali natante leviter arcuatæ adque latera vergentes; articulus ultimus [?] antennæ dextræ maris in hamulum exiens acuminatum. Ramus antennarum 2-di paris exterior interiore parum modo longior, articulo ultimo quam antecedentibus 5 junctis breviore. Articulus ultimus pedum 5-ti paris in femina perrudimentaris tuberculum solum minimum aculeo uno parvo instructum formans; unguis intus curvatus maximus validusque; appendix interna indistincte bi-articulata longitudinem articuli 3-ti-superans; unguis terminalis pedis dextri maris longissimus leviterque arcuatus. Saccus oviferus parva et multa continet ova colore castaneo. Color animalis variat ex fulvo, cæruleo vel rubro. Longit. fem. interdum fere 3 mm. Habitat in aquis stagnantibus."

The description quoted above from Sars does not agree with Claus' or Brady's account of the same species. From what Brady says of the English Diaptomi one would conclude that the same variations occur there as here. D. westwoodii, which he unites with D. castor, is certainly as different from that species as our D. stagnalis is from D. sanguineus. An actual comparison of specimens will be necessary to clearly define the relation of the American and European species.

A species found with us in stagnating pools in early spring, frequently following D. stagnalis and giving place to D. leptopus. It prefers pools less foul than those affected by the latter, though not rarely found with it temporarily. The species is quite variable, and the variations are in directions suggestive of other species. Measurements taken of specimens from a gathering from two pools, one being more stagnant than the other, showed the following results:—males from the less stagnant 1.7 mm.; males from the other pool 2.0 mm.; a difference of 0.3 mm. (Males of D. stagnalis from the latter gathering measured 3.4 mm., while the females of that species vary between 3.8—3.9 mm.) Females measure about 1.8 mm. on an average, of which 1.3 mm. is the length of the thorax. Such individuals have antennæ 1.7 mm. long. The greatest width is anterior to the middle, being about 0.5 mm.

This species differs from D. stagnalis of which, in most respects, is a miniature, by the long antennæ, short abdomen and peculiar armature of the fifth feet.

In the female the fifth foot is about 0.5 mm. long, and the outer ramus has two small spines on the terminal joint, while the segment before the last has a powerful toothed claw. The inner ramus is not evidently two-jointed. The first abdominal segment is spurred on either side. The last thoracic segment extends into a strong angle which bears a heavy spine terminally, and a smaller spine dorsally. On the dorsal median line is a protuberance or "hump" on this segment. In the male the outer ramus of the right foot of fifth pair is long, and terminates in a powerful curved, toothed claw. The inner ramus is small and narrowed toward the end; on the outside of the segment from which it springs is a blunt spine, which is nearly as large as the ramus itself, and has been mistaken for it. The left foot is very fleshy and its inner ramus very rudimentary. The color is brilliant red or purple but variable. Found in the southern states in autumn.

Sp. 3. Diaptomus minnetonka, (Sp. n.)

(Plate Q. Figs. 8—10.)

A small species, smaller than either D. longicornis or D. sanguineus, was gathered in a pool bordering lake Minnetonka, which contained also D. longicornis. It unites the characteristics of both species. The antennæ reach beyond the stylets, the color is dark, the margins of the last segment of the thorax is rather strongly spined, very much as in D. sanguineus. The fifth feet of the female resemble very much those of D. leptopus, but the first segment of the abdomen has a strong spine. The fifth foot of male resembles that of D. sanguineus more than that of leptopus. This species was seen but once, and no measurements can be given save that of the male which was 1.4 mm.

Sp. 4. **Diaptomus armatus,** Herrick.

Is founded upon an imperfectly known form in which the antennæ do not reach the end of the abdomen; the thickened part of the male antennæ short; the antenna armed as in D. sanguineus; the terminal claw of the fifth foot of the male with a tooth near the base; the claw being nearly as long as the ramus.

Sp. 5. **Diaptomus stagnalis,** Forbes.

(Plate Q. Figs. 11 and 13.)

D. giganteus, HERRICK.

The largest species of the genus and, not improbably, too close to D. westwoodii, Lubbock. The general characters are like those of D. sanguineus, but the form is much more robust and the antennæ only moderately exceed the thorax. The proportions may be gathered from the measurements given. In the female the length of thorax is 2.5 mm.; abdomen 1.2 mm.; antennæ 2.3 mm.; stylets 0.1 mm. The caudal stylets are as broad as long, or nearly so. The last thoracic segment extends into an irregular process 0.1 mm. long, bearing a spine dorsally. The first abdominal segment is spurred on either side. The fifth feet in the female have two-jointed inner rami. The terminal segment of the outer ramus is more than ordinarily distinct, while the claw is biserrate. The right foot of the fifth pair in the male is very long, its claw being strongly toothed. On the inside of the second joint from the base is a disc-like appendage peculiar to this species. The left foot is short. The longer ramus is three-jointed, but the terminal joint is a mere curved spine, opposing a spine from the penultimate segment, which is covered with minute spines or teeth. The basal joint of the ramus has a bristly protuberance distally. The inner ramus is marked with oblique ridges. The right antenna has a powerful hooked spine on the antepenult segment, the two segments beyond which coalesce in maturity as in the other related species. For measurements see above. Color deep opaque red or purple. Appearing in early spring as soon as the ice is melted from the pools which it inhabits. In the south it occurs in autumn. The name above given seems to have the priority, although this species was figured and described at about the same time in the annual of this survey.

Sp. 6. **Diaptomus longicornis,** Herrick

This name was applied somewhat loosely, the description given being incomplete, but re-examination of types shows it to belong unquestionably to the form since described as *D. leptopus*. In our state we have found another variety, in general, almost identical with the type specimens, but nearly twice as large. It is now proposed to extend the significance of this name so as to include both varieties, which will undoubtedly be found connected by intermediate forms, thus retaining the name given by Forbes for the variety to which it in particular applies.

(a) **var. leptopus,** Forbes.

This species is the commonest member of the genus in small lakes and clear pools. It is tolerably constant in coloration, but varies somewhat in size. The original description is insufficient to identify the species definitely, but taken in connection with the figure and the measurement, could hardly be refered to either of the other American forms. This species is characterized by the very compact thorax, the margin of the last segment of which has two very minute spines; and by the form of the fifth feet. The antennæ reach nearly to the end of the caudal setæ, while in the next they fall short of the length of the stylets. The outer spines of the swimming feet are denticulate on the outer margin and setose within. The fifth feet of the female are compact, the inner ramus is more or less obviously two-jointed; the third joint of the outer ramus is almost obsolete and has two short spines; the claw of second joint is strongly denticulate. The male fifth foot has a rather long inner ramus which is very imperfectly two-jointed; the left foot is rather long; the claw of the right foot is armed with crenulate teeth. Length 1.5—1.7 mm., without setæ. The body, which is broadest anterior to the middle, is bluish; the tips of the antennæ are deep purple. The eggs are not as numerous as in the

(b) var. similis. (Var. n.)

(Plate Q. Figs. 5—7.)

This form is twice as large as D. leptopus, but otherwise scarcely distinguishable. It occurs in autumn (and spring?) in shallow pools, which can but be frozen solid. The following differences are the only points yet noticed. Females of both of the species were placed side by side upon a slide and examined. D. leptopus measured 2.4 mm., exclusive of caudal setæ; the antennæ reached hardly to the base of the stylets; the eggs measured 0.12 mm., while those of D. longicornis measured 0.8 mm.; the egg-sac measured 0.8 mm., while that of longicornis was 0.5 mm. A few other minute differences were noticed, but the general form and color was identical. The peculiar doubling of the edge of the last segment is characteristic of these two forms; each has a small spine on either side of the abdomen. The base of the inner ramus of left foot of fifth pair of the male has a double series of spines.

Sp. 7. Diaptomus laticeps, Sars.

"Cephalothorax antice dilatatus, latidudine maxima in parte antica capitis sita, postice sensim attenuatus, segmento ultimo feminæ ad latera parum extante angulis lateralibus acuminatis. Segmentum 1-mum abdominale feminæ antice latum mucrone brevi laterali armatum, postice sensim attenuatum. Rami caudales sat magni segmenta antecentia 2 juncta longitudine æquantes setis brevissimis et robustis instructi. Antennæ 1-mi paris feminæ longitudinem corporis æquantes, animali natante rectæ et quam in D. gracili adhuc magis postice vergentes; articulus antepenultimus antennæ dextræ maris hamulo armatus. Ramus exterior antennarum 2-di paris interiore multo longior articulo ultimo longitudinem articulorum anticedentium 5 æquante. Pedum 5-ti paris feminæ articulus ultimus parvus, cylindricus, non vero tam rudimentaris quam in D. castore, aculeo uno brevi apicali instructus; appendix interna ne tertiam quidem longitudinis articuli 3-ti partem æquans et uniarticulata; pedis dextri maris articulus 3-tius extrorsum aculeo forti armatus, ungue terminali valde flexuoso et subsigmoides; sinister aculeis duobus rectis terminatus. Saccus oviferus sat multa continet ova. Color pleurumque læte cæruleus, interdum pallidior, albescens. Longit. feminæ circit. 1½ mm."

Sp. 8. Diaptomus gracilis, Sars.

"Corpus quam in D. castore gracilius, cephalothorace et antice et postice attenuato, latitudine maxima in medio sita. Anguli laminarum segmenti ultimi thoracalis feminæ in mucrones tenues et acuminatos producti, et mucrone simili sat magno segmentum 1-mum abdominale utrinque armatus est. Rami abdominales breves setis in femina valde divergentibus. Antennæ 1-mi paris feminæ perlongæ et tenues, longitudinem totius animalis longe superantes, animali natanti rectæ et aliquantum postice vergentes; articulus antepenultimus antennæ dextræ maris hamulo longior, articulo ultimo rami dimidium longitudinem æquante. Pedum 5-ti paris feminæ articulus ultimus distinctus, quadratus aculeis duobus apicalibus quorum interior apicem fere unguis articuli penultimi attingit instructus; appendix interna articulo 3-tio brevior; unguis terminalis pedis dextri maris apicem versus valde curvatus. Saccus oviferus semper ova continet paucissima et magna regulariterque distributa. Animal pleurumque pellucidum colore albido, interdum vero facia transversa lata coloris fusci saturati in medio cephalothorace ornatum. Longit. feminæ parum supra 1 mm."

The two forms following are sufficiently distinct from the above and form a closer link with the marine Calanidæ. It is doubtful if any absolute line of demarkation exists between these varieties, although they are here distinguished.

Sp. 9. Diaptomus pallidus, Herrick.

(Plate Q. Fig. 17.)

Length 1.20 mm.; length of antennæ 1.35 mm. Colorless. Head separated by a suture into two parts; form very slender. Antennæ with elongated setæ, which are very plumose. The right male antenna has no hook. The inner rami of the fifth feet are one-jointed in both sexes. Left foot of the fifth pair of the male of peculiar form (see plate Q, fig. 17, for an extreme instance). Entire Mississippi valley.

var. sicilis, Forbes.

(Plate Q. Fig. 18.)

Like the above, but larger. Length 1.45 mm. Length of antennæ 1.5 mm. Inner ramus of male feet of fifth pair two-jointed, those of the female one-jointed. The form of feet varies a little from the above. This species has been but once encountered in Minnesota, the previous species occurring abundantly in our larger lakes.

D. kentuckyensis, Chambers, is referable to one of the above species, probably D. longicornis.

For a full account of synonymy see Rehberg, *Beitrag z. Kenn. d. freileb. Suesswasser Copepoden*, p. 552.

VI.—GENUS LIMNOCALANUS, Sars.

Cephalothorax 6-jointed, slender; abdomen in the female 3-jointed, in the male 5-jointed. Antennæ shorter than the body, 25-jointed. Caudal stylets long. Feet of the four anterior pairs with both rami 3-jointed; external ramus of the fifth foot in the female 3-jointed, second joint produced into a spine; inner rami 3-jointed in both sexes and like those of the previous pairs; external rami 2-jointed in the male, the right and left dissimilar.

Sp. 1. Limnocalanus macrurus, Sars.

A species similar to L. macrurus has been found in lake Michigan, and probably occurs also in this state in lake Superior. We can do no better than quote Sars' description.

"Corpus gracile et angustatum. Cephalothorax supra visus elongato ovatus, latitudine maxima in medio sita antice et postice æqualiter attenuatus. Caput annulum unicum præbens, a latere visum parte antica altiore et convexa sinu distincto a posteriore disjuncta, margine antico oblique descendente. Segmentum ultimum thoracis parvum neque ad latera extans in femina et mare simile. Abdomen sub-cylindricum thorace longius. Rami caudales valde elongati et angustati tertium longitudinis abdominis partem superantes, supra et ad latera spinulis vel pilis brevibus obsiti, intus ciliati, setis 5 majoribus uniarticulatis et ciliatis, quarum 2-da ab interiore numerata omnium longissima ceteræque extus graduatim longitundine decrescentes, exteriore ceteris minore absque apice sat remota ; seta adest præterea alia intus adfixa ut in generibus antecedentibus tenuissima et simplex. Frons a latere visa obtuse acuminata appendicibus tentaculiformibus duabus perbrevibus instructa. Antennæ 1-mi paris reflexæ segmentum penultimum abdominis minime attingentes, articulo ultimo setis 5, quarum posteriores 2 longissimæ, instructo, articulis antecedentibus 3 setæ simili postice vergente præditis ; dextra maris articulatione inter articulum 18-mum et 19-mum geniculans. Antennarum 2-di paris ramus exterior interiore et longior et latior, 7-articulatus, articulo 2-do omnium maximo, sequentibus 4 minimis junctis articulo ultimo brevioribus setisque longissimis instructis. Mandibulæ ad extremitatem inferiorem in dentes exeuntes 9, quorum exteriores 2 ceteris majores, interiores 2 tenues et setiferes sunt ; palpus longus et angustatus 3-articulatus, articulis ultimis 2 brevissimis, ramo exteriore, vel appendice branchiale, parvo. Maxillæ 1-mi paris eadem fere structura ac in Diaptomo. Maxillæ 2-di paris validissimæ 8-articulatæ, articulis ultimis 5 in ungues exeuntibus longissimos et fortissimos margine altero sparsim pilosos, ad apicem falcatum vero nudos vel aculeis persubtile et dense obsitos ; 3-tii paris [Maxillipedes] valde elongatæ et angustatæ antice vergentes articulis 7 setis pleurumque longis præditis compositæ. Pedes omnes biramosi natatorii, ultimo pari in mare bi-articulatus in pede dextro et sinistro dissimilis, articulo ultimo in illo brevi et robusto ad apicem quasi truncato dentibusque 3 parvis et obtusis armato intus vero in aculeum magnum et validum excurrente, in hoc valde elongato extus et ad apicem aculeato intus vero nudo. Oculus unicus propius marginem inferiorem capitis situs. Animal quamquam pellucidissimus et fere omnino hyalinum, facile tamen accumulatione in thorace sat magna liquoris oleosi læte fulvo-rubide colorati se prodit. Longit. circit. 2½ mm."

FAMILY CYCLOPIDÆ.

Contains five genera, viz: *Thorellia*, *Cyclops*, *Oithona*, *Lophophorus* and *Cyclopina*; passing, by the genera *Misophria* and *Pseudo-cyclops*, into the *Calanidæ* or marine copepods. The affinities of these little known genera need further study, as they are very interesting, the question being still open in how far the cyclopoid forms are altered by adaptation to saline habitat, if such an adaptation takes place at all.

Cephalothorax ovate and usually much more robust than the abdomen; anterior antennæ seldom longer than the cephalothorax, those of the male alike on both sides and modified for the purpose of clasping; posterior antennæ unbranched (i. e. palpus wanting);

palps of mandibles and maxillæ usually well-developed; foot-jaws mostly less developed than in *Calanidæ*; first four pairs of feet as in *Calanidæ*, fifth pair rudimentary, alike in both sexes, and usually one- or two-jointed; ovisacs two.

The circulatory system of this family is partly lacunal and has been thought to be entirely so in the genus Cyclops. closer observation, however, shows that there is something like an imperfect central organ at the point occupied by the heart of higher Copepods. This was figured in my previous report, plate V, fig. 1, but no mention was made of the discovery. It has since been verified. The apparatus referred to is a modification of that described under Canthocamptus. In the second thoracic segment there is a set of swaying membranes which constitute a valvular apparatus, chiefly moved by the action of the stomach.

GENUS CYCLOPS.

The sole representative of the genera of the Cyclopidæ here treated is the best known of the Copepoda. Every one is familiar with the "common cyclops," but few realize how many are the species included under this name. An attempt is here made to enable the student to recognize the more obvious distinctions upon which the genus is subdivided and to identify such of the species as seem valid and at the same time recognizable without recondite study of development. Without attempting a complete elucidation of the synonymy, which is practically an impossibility, a proximate classification of all the species known to me is attempted. Thirty sufficiently well marked species are enumerated, and the position of a number more is indicated.

Antennæ 18-jointed.

Sp. 1. Cyclops elongatus, Claus.

This species, cited hitherto, apparently, by but one other author than Claus, is distinguished from the C. pulchellus group by the 18-jointed antennæ, which are hardly longer than the first thoracic segment. The caudal stylets are longer than the two preceeding abdominal segments, and bear rather short setæ. C. elongatus has been found by Cragin near Cambridge. That this species, found thus far by but a single author in Europe, appears in America, may serve as a warning not to decide too hastily from its habitat that a copepod is new.

Antennæ 17-jointed.

I.—FIFTH FOOT 1-JOINTED.

Sp. 2. Cyclops ater, Herrick.

(Plate Q². Figs. 9—12.)

This is our most striking species and loves the clearer flowing waters. The thorax is broadly oval and, usually, of a deep color. Antennæ as long as the cephalothorax (1.2 mm.), slender, and tapering toward the end; formula[1] – ⏓ ⏑ – – ⏑ – ⏑ ⏑ ⏑ ⏑ ⏓ ⏓ ⏑ – – –; last three joints rather short, the last joint furnished with an unserrated knife-like ridge as in C. tenuicornis; maxillipedes rather large; fifth foot one-jointed, armed with three subequal spines; abdomen rather short, last segment especially short; stylets of moderate length; setæ rather short, internal seta much longer than the outer, lateral seta near the end of the stylet; eggs pale. Color deep blue or gray. Length 2.1 mm. The young can be recognized without a glass by the band of deep color which crosses the thorax in the middle.

Collected near Minneapolis, in "Mud lake" and Bassett's creek.

This species has been collected in different parts of the Mississippi valley from Alabama to Minnesota, but is nowhere very abundant, being but rather more so southwardly.

II.—FIFTH FOOT 2-JOINTED.

A.—*First joint of fifth foot very broad.*

Sp. 3. Cyclops viridis, Jurine. (Rehberg.)

(var. a.)
  C. vulgaris, KOCH, FISCHER, SARS.
  C. brevicornis, CLAUS, LUBBOCK, HELLER, FRIC, HOEK.
  C. viridis, CRAGIN.
(var. b.)
  C. gigas, CLAUS, SARS, FRIC, BRADY.
  C. ingens, HERRICK.

The American form is usually somewhat different from the C. gigas, but the stage prior to maturity is like that figured by Brady. Observations made over a considerable territory and for a period of several years led me to the conclusion expressed by Rehberg (Ab-

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[1] The accent marks are used to signify that joints represented by them (counting from base) are either long –, short ⏑ or medium ⏓.

ereine zu Bremen. Bd. vii, 1. Heft. p. 62)
a greatly enlarged form of C. brevicornis. See
ralist, May, 1883, p. 499, where I have expressed
garding the American form.

ginal description of C. ingens is here given.
domen rather slender; stylets slender, with the
wards the end; second and third setæ alone long,
last joint but one of abdomen sometimes toothed
under margin; jaws with large teeth; antennæ very
ng to the base of the first cephalothoracic segment;
[illegible] fifth foot two-jointed, the
very broad with a strong spine; second joint cylindri-
g seta and a very short spine near the end; oper-
somewhat heart-shaped; egg-sacs oval-elongated,
nd the end of abdomen; length 4 mm., including
tæ.

Sp. 4. **Cyclops leuckartii**, Claus.

ISCHER.

be elongated and slender; the antennæ are nearly as
first three segments. The fifth foot is like the smaller
e above, but the second joint has only one spine. The
s of the caudal setæ are very much as in the above.
g denies that Sars' identification of this species so briefly
by Claus is correct; his description is therefore copied.
rs also with a query to C. obsoletus, Koch.

othorax ovatus antice sat attenuatus, fronte leviter truncata, segmento ulti-
vixque ad latera exstante. Segmentum abdominale 1-mum sub-cylindricum
am postice parum latius. Rami caudalis brevisculi longitudinem segmentorum
ntium duorum non attingentes setis apicalibus sat longis, externa furcæ
inem æquante dimidiamque interni, intermediarum interiore altera aliquanto
longitudinem abdominis fere æquante; seta marginis exterioris ab apice sat
Antennæ 1-mi paris 17-articulatæ, longæ et apicem versus attenuatæ,
segmentum 4-tum corporis fere attingentes; 2-di paris quam in speciebus
ongiores. Maxillarum 2-di paris margo posticus subtilissime crenulatus. Pedes
bi-articulati, articulo ultimo bisetoso. Rami pedum natatoriorum omnes 3-ar-
articulus rami exterioris intus setis 3, extus aculeis 2 instructus. Lamina par-
les pedum 4-ti paris conjugens utrinque in processum acuminatum exit. Rami
s articulus ultimus insolito modo in longitudinem extensus in pedibus 4-ti paris
picalibus 2 subæqualibus armatus. Sacci oviferi rotunda to-ovati ab abdomine
ntes. Longit. parum supra 1 mm."

Sp. 5. **Cyclops lacustris**, Sars.

ovate, truncate in front. Abdomen nearly of equal width; caudal stylets longer than the last two segments of the abdomen terminal; setæ of moderate size, inner three times as long as outer, internal pair nearly equal. Antennæ as long as first two segments. The inner ramus of fourth foot has the exterior thorn very small. The second joint of the fifth foot is small and the external thorn very small. Length 1.5 mm.

Not seen in America.

B.—First joint of fifth foot of moderate size.

(a) Terminal segment of fifth foot with one long seta and a short thorn.

These small species pass into the above group and constitute one of the most difficult groups of the genus. The distinctions offered are very small and specific variation considerable.

Sp. 6. **Cyclops strenuus,** Fischer.

? *C. pictus*, KOCH.
C. brevicaudatus, CLAUS, LUBBOCK, HELLER, FRIC.
C. strenuus, SARS, BRADY.

Antennæ reaching about to the end of the third segment; caudal stylets slender, three times as long as the last segment; the outer of the caudal setæ shortest. The third seta is over once and one half the length of the stylet.

Sp. 7. **Cyclops lucidulus,** Koch.

C. lucidulus SARS.
C. furcifer, CLAUS.
C. vernalis, FISCHER.

This species is given on the authority of Rehberg. Claus considered C. furcifer a large variety of the above species.

The antennæ are as long as the first segment; the fifth foot is peculiar in form, with the second joint armed with a spine and a hook; length 1.3 mm.

Neither this nor the previous species is known in America.[*]

Sp. 8. **Cyclops robustus,** Sars.

Antennæ shorter than first segment, thick. Body depressed, first segment broad and rounded anteriorly, the others spreading; caudal stylets nearly parallel, long; inner median seta much the longer, external setæ very short. Terminal joint of outer rami with three spines externally and four setæ internally. Length 1.3 mm. I know nothing of this species save the description of Sars, a part of which is quoted above.

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[*] **C. pulchellus,** Brady is not C. pulchellus, Koch, and may be the above species.

Sp. 9. Cyclops parcus, Herrick.

(Plate R. Fig. 22.)

Cyclops parcus, HERRICK, Crustacea of Minnesota, p. 229; Plate VI., Figs. 12—15.

In form and general appearance greatly resembling Cyclops thomasi, which it nearly equals in size. The chief differences are found in the length of the caudal stylets and antennæ and in the form of the fifth foot. The antennæ are shorter than, or about as long as, the first thoracic segment. The formula expressing the length of the joints corresponds with that for C. thomasi. The antennules are shortish. The labrum is rather narrow, projecting below into obtuse angles, the middle of the lower face being occupied with nine rather small teeth. The terminal joint of the larger branch of the maxilliped bears four hairs. The second joint has a moderately large dactyl, the movable finger of which is small and sparsely spiny, the immovable finger is ornamented by an oblique series of blunt prominences and a small seta at its base. The first pair of feet has two terminal and two interior setæ and two external spines on the ultimate joint of the outer ramus, while the corresponding joint of the inner ramus bears one inner seta and large spine and three outer setæ. The fourth foot has, in the first case, two outer spines, a terminal spine and seta and three internal setæ, and, in the second, one external seta, two subequal terminal spines and two internal setæ. The fifth foot is two-jointed, bearing on the short basal joint a moderate seta and on the larger second joint a considerable seta and a small oval spine on its side. The caudal stylets are short and the lateral seta is near the end (about 1·5). The outer seta is but three-fourths the length of the inner. The inner of the median setæ is considerably longer than the outer. The shape of the operculum of the female is very characteristic, it being nearly oval. The last two joints of the thorax are acute. The entire length is about 1.5 mm.

Sp. 10. Cyclops brevispinosus. (Sp. n.)

(Plate S. Figs. 7—11.)

The form for which this name is proposed takes the place of the above in the larger lakes. It appears to be but a modified condition of the above species, from which it differs in its slender form and especially in the very slender caudal stylets. The outer caudal seta is reduced to a short ciliate thorn. The fourth foot is also modified by the great enlargement of the spines and the reduction of the setæ. The number of the setæ is the same, but they are differently disposed. The form of the operculum vulvæ is also slightly different.

(?) Sp. 11. Cyclops uniangulatus, Cragin.

Cyclops uniangulatus, CRAGIN. A Contribution to the History of Fresh-water Copepoda, p. 6.

Cragin was not conversant with the description of C. parcus, with which his description agrees save in one point. It differs from C. parcus in having three inner setæ on the terminal joint of the outer ramus of the first foot. It would be officious to suggest a possible oversight here, but C. parcus has only two in type specimens (though in all this group the corresponding ramus of the *second foot* has three setæ), so that at present the two must be kept distinct.

Sp. 12. Cyclops scutifer, Sars.

Not having identified this and the following species it will be best to quote the descriptions.

C. strenuo affinis. Cephalothorax sat elongatus, segmentis ultimis duobus in femina ad latere valde prominentibus inque processos exeuntibus laminares et hyalinos utrinque inter se contiguos, quare thoracis pars posterior tamquam clypeo fornicato quadrangulari obtecta esse videtur. Segmentum 1-mum abdominale ad basin valde dilatatum latitudine quam ad marginem posteriorem duplo majore. Rami caudales segmentes antecedentibus duobus junctis parum longiores, introrsum ciliati, setis apicalibus brevissimis, intermediarum interiore ceteris multo longiore. Antennæ 1-mi paris 17-articulatæ, reflexæ segmentum 2-dum corporis superantes setis plurumque longis obsitæ. Pedum structura eidem in C. strenuo similis. Articulus scilicet ultimus rami exterioris pedum natatoriorum setis 5 instructus in paribus anterioribus duobus 3, in sequentibus duobus 2 modo aculeis marginis exterioris armatus; aculeorum apicalium rami interiores pedum 4-ti paris exterior brevis et rudimentaris. Pedum 5-ti paris articulus ultimus sat magnus articulo basali parum minor extrorsum sparsim pilosus introrsum aculeo armatus ciliato setaque longa terminali. Sacci oviferi parvi globosi abdomen magna ex parte obtegentes. Longit. circit. 1½ mm.

Sp. 13. Cyclops abyssorum, Sars.

C. strenuo et scutifero sat affinis. Cephalothorax ovatus antice obtuse truncatus, segmentis parum ad latera extantibus. Rami caudales longi et tenues satisque divergentes, longitudinem segmentorum antecedentium 3 superantes, setis apicalibus longioribus intermediarum interiore duplam longitudinem furcæ superante, exteriore quam illa parum breviore. Antennæ 1-mi paris 17-articulatæ longæ et fere rectæ distincte postici

vergentes, reflexæ segmentum 3-tium corporis fere attingentes. Pedum natatoriorum structura fere eadem ac in speciebus antecedentibus ; aculeorum apicalium rami interioris pedum 4-ti paris exterior dimidiam fere interioris attingens longitudine. Pedum 5-ti paris articulus basalis minimus ultimo multo brevior parumque latior. Sacci oviferi mediocres rotundato-ovales abdominique appressi. Longit. circit. 2 mm.

(b) Terminal segment of fifth foot with two rather long setæ.

* External and internal caudal setæ not extremely short.

Sp. 14. **Cyclops oithonoides,** Sars.

(Plate S. Figs. 2—6.)

? *C. hyalinus*, REHBERG.
? *C. tenuissimus*, HERRICK.

This most interesting species occurs under peculiar circumstances. It is perhaps the rarest member of the genus and seems, beyond a doubt, nocturnal in its habits. It was first found by Sars in saline water and named, on account of its slender form, from the marine Oithona. A similar species which, though about half as large, is hardly distinct, was found by Rehberg near Bremen. Rehberg mentions particularly that it was found oftener at night than during the day. In America a similar species was described from near Paducah, Ky., under the name C. tenuissimus; but the possibility of identity with the Scandinavian species seemed excluded by the habitat. A gathering taken at night from one of the lakes near Minneapolis contained a few specimens of similar characters, and there no longer seems to be a doubt of the identity or very close relation between these forms.

The antennæ are longer than described for C. tenuissimus, nearly equalling the thorax. The last joint of the antennæ is short, but the toothed character was not noted. The fifth feet are small, the spines are very long and slender. The margins of the abdominal segments are irregularly toothed. The species will be confused with no other. It is marked with blue in spots. Length 0. 5—1. mm.

Sp. 15. **Cyclops simplex,** Poggenpol.

Cyclops Leeuwenhockii, HOEK (fide Rehberg).

This species is of more compact form than the last, which it resembles in the form of the caudal stylets and the fifth foot. The antennæ are nearly as long as the thorax, the last two joints being elongate and having a knife-like ridge which has at the end teeth like those figured in C. tenuissimus. Length 1.—2. mm.

** The two median setæ much longer than the external.

The species of this section are the most perplexing of the genus. The best that I can now do is to indicate the relations of the nominal species and express the conviction that most are of varietal value simply.

Sp. 16. Cyclops pulchellus, Koch.

C. bicuspidatus, CLAUS.

† Terminal joint of outer ramus of feet with two spines outwardly.

16 a. *C. thomasi*, Forbes.

16 b. *C navus*, Herrick.

†† With three spines.

16 c. *C. bisetosus*, Rehberg.

C. bicuspidatus, Sars.

(?) *C. insectus*, Forbes.

There are at least three well marked varieties in America, which may probably rank as species and have been ranked as such by Forbes. I give verbatim Forbes' description.

(16a) Cyclops thomasi, Forbes.

(Plate U. Figs. 4, 5, 7 and 8.)

"Elongate, slender, broadest in front and tapering backward, antennæ 17-jointed, reaching the middle of the third segment.

The first abdominal segment in the female is broad in front and slightly emarginate on each side before the anterior angles, and the last segment has a terminal circlet of small spines. The rami of the furca are more than half as long as the abdomen, and each bears two short rows of transverse spinules outside, one at the anterior the other at the posterior third. With the latter a spine occurs about as long as the outer terminal seta. The inner seta at the tip of the ramus is about half the length of the furca, the outer still shorter. The inner median seta is as long as the abdomen and furca, and the outer about half as long.

In the outer ramus of the first pair of legs the terminal joint has one spine and two setæ at the tip, one spine on the outer margin and two setæ within.

In the second, third and fourth pairs the last joint has one spine and one seta at tip, two spines externally and two setæ within. The inner rami of the second and third pairs terminate in one spine and one seta, that of the fourth pair in two spines, the inner of which is only half as long as the other.

The legs of the fifth pair are two-jointed, with the basal joint quadrate, broad, and bearing one long spine. The second joint is narrow and longer, parallel and truncate, with one terminal spine about equal to the preceding, and one about half that length.

From *C. bicuspidatus*, Claus, this species may be distinguished by the armature of the outer ramus of the first pair of legs, and from *C. bisetosus*, Rehberg, by the armature of the outer rami of the other legs.

It shares with *Diaptomus sicilis* the responsibility of affording to the young white-fish their earliest food."

(16 c) **Cyclops insectus,** Forbes.

(Plate U. Fig. 9.)

"Closely allied to the preceding, but more robust in all its parts, and with the second cephalothoracic segment widest. The abdominal segments are all bordered with spinules posteriorly. The two median caudal setæ are much more nearly equal than in *thomasi*, the outer and the inner are very short, but longer than in that species. The inner in our specimens is longer than the outer —the reverse being the case in *bicuspidatus* as described by Claus.

"The legs are armed nearly as in *thomasi*, but the last joint of the outer ramus of the first pair has two spines externally besides the one at the tip, and the terminal spines on the last segment of the inner ramus of the fourth pair of legs are about equal."

Both forms probably occur in Minnesota, though the second has been seen but once, and the identification lacks confirmation. The differences between the two are almost exactly those prevailing between C. bicuspidatus (= pulchellus) and C. bisetosus, Reh., if I correctly understand Sars. Claus' description does not agree with that of Sars. Further study of the European types will be necessary before a satisfactory settlement can be reached.

(16 b) **Cyclops navus,** Herrick.

Cyclops navus, HERRICK, Copepoda of Minnesota, p. 279.

This name, proposed at nearly the same time as C. thomasi, applies to a very closely related form which I can but regard as a variety of that species. It seems constant in its differential characters in given localities, but we are now familiar enough with the fact that changed conditions in the water occasion changes in forms in the copepods.

This form inhabits shallow pools. It is larger than C. thomasi, has much shorter stylets and differently proportioned antennæ, etc.

Length 1.5 mm. Thorax 0.9 mm.; abdomen 0.6 mm.; stylets 0.14 mm.; last two abdominal segments 0.16 mm.; antennæ 0.7 mm.; first segment of body 0.5 mm. The basal segment of the antennæ is long and ornamented with several transverse series of spines, the last two segments are equal and longer than the preceding. The armature of the first and fourth feet is identical with C. thomasi, as is the form of the female openings and the fifth feet. The form of the first feet, caudal stylets and other details were correctly figured on plate V of the Cyclopidæ of Minnesota.

Specimens of Cyclops pulchellus (thomasi) were obtained from a cistern which is supplied solely by rain-water. The eggs must have been introduced in ice which had been placed in the cistern at least a year previously. The cistern is entirely dark, so that these animals must have been deprived of light for many generations. The general color was of course very white; the eye spots were pale, but present with some pigment and the lenses. No noticeable alteration in form had resulted.

(c) Terminal segment of fifth foot with three setæ.

Sp. 17. Cyclops tenuicornis, Claus.

(Plate R. Fig. 16.)

var. a. **Knife-like ridge upon the antennæ smooth.**
  C. *albidus*, JURINE,
  C. *quadricornis*, *var. b*, BAIRD.
  C. *tenuicornis*, SARS ,LUBBOCK, HELLER, FRIC, ULJANIN, HOEK, BRADY, HERRICK.
  C. *clausii*, POGGENPOL.
  C. *annulicornis*, SARS.
var. b. **Knife-like ridge of antennæ toothed.**
  C. *obesicornis*, TEMPLETON.
  C. *signatus*, KOCH, SARS, ULJANIN, BRADY.
  C. *coronatus*, CLAUS, LUBBOCK, HELLER, FRIC, HOEK
  C. *signatus*, *var. fasciacornis*, CRAGIN.

Cyclops tenuicornis, as thus comprehended, is widely distributed and variable. European specimens in our collection have longer stylets, but seem otherwise identical. The nearest relation is *C. ater*, which is easily distinguished by the compact oval form of the thorax and the one-jointed fifth foot. In the stage previous to maturity the "signatus" form has no teeth upon the ridge of the last segment of the antennæ; it is then similar to the C. tenuicornis.

Cephalothorax broad; abdomen rather slender; antennæ reaching about to base of thorax, attenuated at the end; terminal joint with a knife-like ridge; formula –⏑⏑–⏓⏑–⏑⏑⏑⏑⏑⏑⏑–––; fifth foot composed of a long basal joint bearing a long spine and a terminal three-spined division; caudal stylets twice as long as last abdominal segment; setæ all nearly terminal, inner one long. Length 2.5 mm.

Common in America, England, continental Europe, etc. C. clausii, Poggenpol, is known to me only from the citations of Rehberg and the translation given by Cragin, hence I can not judge authoritatively of its validity. Certain points in the translation are obviously erroneous, as where the larger branch of the fifth foot is spoken of. No distinctions sufficiently clear to enable us to separate it from C. tenuicornis can be gathered.

III.—FIFTH FOOT 3-JOINTED.

(See Cyclops modestus.)

Antennæ 16-jointed.

There are a few forms which, although they might more properly be ranked with the previous section, seem rarely or never to acquire more than sixteen joints.

Sp. 18. Cyclops languidus, Sars.

Thorax attenuated posteriorly, caudal stylets exceeding in length the two preceding segments, internal seta short, half as long as the outer, the inner of the median setæ as long as the abdomen. Both rami of the first foot and the inner of the second are two-jointed. Second joint of the fifth feet sub-linear, armed with a seta and a spine. The fact that some of the feet have two-jointed rami suggests a young stage of some other forms.

This species has not been seen in America.

Sp. 19. Cyclops modestus, Herrick.

(Plate R. Figs. 1—5.)

American Naturalist, 1883, p. 500 (May).

This small species, 1.0 mm. long, was first recognized in Cullman county, Alabama, but occurs also in our lakes. The color varies, but very characteristic is the peculiar shining or glaucous surface of the strongly arched thoracic shield and the evenly curved segments of the abdomen. The antennæ reach but little beyond the very long first segment; they are usually 16-jointed, but I have notes of a similar form in which the antennæ are 17-jointed. The feet are all 3-jointed and are peculiar in their armature. The fifth foot is obscurely 3-jointed, the second joint bearing a short spine and the terminal joint two spines of varying length. The stylets are once and a half as long as the last segment and are peculiarly excavated for more than the lower third, from the point where the lateral spine is situated. The outer terminal seta is short, the others being sub-equal and also short. The opening of the spermatheca is elongated, oval. The antenna of the male is divisible into five regions, the third being formed by the thickening and coalescing of four or more segments.

Antennæ 14-jointed.

Sp. 20. Cyclops insignis, Claus.

The two forms here belonging might be considered atavic varieties of Cyclops pulchellus. Brady's figures and description of his *C. insignis* (= C. lubbockii) agree almost exactly with what Rehberg says of Cyclops helgolandicus (Abh. v. naturw. Vereine zu Bremen, vii. l. pp. 62—64). Rehberg regards that species as an atavic sub-species or variety of C. pulchellus. With C. insignis, Claus, the case seems to be different. The occurrence of this species is not conditioned by marine influence. I found it abundant about Leipzig, Saxony. The differences between it and the C. insignis of Brady are, as the latter says, very slight. Figs. 11—14 of plate T are drawn from Leipzig specimens, from osmic acid preparations. The first foot, outer ramus, has three external spines on the distal segment, two setæ at the end, and three within; the inner ramus has one internal seta, a spine and a seta terminally, and three external setæ on the distal segment. The outer terminal segment of the fourth foot is like the first; the inner one has only two external setæ. The external setæ of the caudal stylets exceed half the length of the stylet and are pectinate. The fifth foot has a short basal joint armed with a single seta, the second joint being slender and armed with two unequal setæ. The gathering above mentioned, taken near Leipzig, Dec., 1881, contained scarcely a female among scores of males in various stages of development. This is so contrary to what is expected that, notwithstanding the apparently good characters on which the species is founded, an uncertainly exists in the mind of the writer as to the permanent adult characters of this species.

Antennæ 12-jointed.

I.—FIFTH FOOT 2-JOINTED.

A.—*Terminal segment of fifth foot with a seta and a small spine.*

Sp. 21. Cyclops capillatus, Sars.

"Cephalothorax sub-ovate; anteriorly uniformly rounded; segments projecting somewhat laterally, the last being scarcely wider than the first abdominal segment. Abdomen attenuated posteriorly; caudal rami almost as long as the last three abdominal segments, hardly divergent, the external and internal apical setæ short and nearly equal; the interior of the median setæ as long as the abdomen; lateral seta about in the middle of the stylet. Antennæ of the first pair robust, slightly exceeding the first segment of the body when reflexed, with the twelve joints densely covered with long and divergent hairs. The last joint of the outer rami of swimming feet are elongated and armed externally with three spines, internally with four setæ; the interior apical spine of the interior rami of the fourth pair of feet longer than the exterior. Feet of the fifth pair large, with a large and thick basal segment and a small oval second joint bearing one long seta and a short spine. Ova-sacs small, narrow and divergent. Eye very small. Length nearly 2 mm."

Very close to C. viridis in many points. Found only in Scandinavia.

Sp. 22. Cyclops crassicaudis, Sars.

Cephalothorax elongate-ovate; segments produced laterally, especially the last, which extends into a somewhat procurved process. Abdomen short and thick, first segment somewhat excavated; caudal rami equalling the last two segments of the abdomen. External apical seta longer than the internal, both short; median setæ long. Antennæ of the first pair 12-jointed, scarcely longer than the first segment. Swimming feet short and thick, spines and setæ short; the interior apical spine of the last joint of the inner ramus of the fourth foot almost twice as long as the exterior spine. Terminal joint of the fifth foot small, armed with a spine and a seta; seta of the basal segment short. Ova-sacs oval, somewhat divergent. Length 0.75 mm.

Found only in Scandinavia.

II.—Fifth Foot 1-jointed.

Sp. 23. Cyclops varicans, Sars.

"Cephalothorax ovate, attenuated about equally in front and behind, with the last segment wider than the abdominal segments, produced laterally and bearing a long seta. Abdomen elongate; caudal rami scarcely as long as last two segments; the internal apical seta twice as long as the outer; median pair elongated, the internal one as long as the abdomen. Antennæ 12-jointed, robust, shorter than the first thoracic segment. * * Both rami of swimming feet two-jointed. * * Feet of fifth pair rudimentary, with a single linear segment bearing a long spine. Ova-sacs long, divergent. Length 1 mm."

Very possibly the young of some species not now identifiable. Only mentioned by Sars. (Compare C. diaphanus below.)

Sp. 24. Cyclops serrulatus, Fischer.

(Plate O. Figs. 17—19.)

? *Cyclops agilis*, KOCH (fide Rehberg).
Cyclops serrulatus, LILLJEBORG, CLAUS, SARS, LUBBOCK, HELLER, FRIC, HOEK, BRADY.
Cyclops longicornis, VERNET.
Cyclops pectinifer, CRAGIN.

Although Rehberg positively asserts that Koch's name applies to the present species, none of the numerous authors who have mentioned this most widely distributed form have employed any other than the familiar designation, and the practical advantage to be derived from its use seems to outweigh a quibble of doubtful synonymy.

Cephalothorax oval, compact; abdomen slender and short, suddenly enlarged previous to its union with the thorax; antennæ slender, reaching nearly, but not quite to the last thoracic segment; the last three joints are attenuated and furnish the most evident character of the species; formula – ⏓ ⏑ – ⏑ ⏑ ⏓ – ⏑ – – –; during life the antennæ tend to assume the form of a rude Z, the proximal four joints forming the base; antennules small, reaching about to the sixth joint of antennæ; jaws small with large teeth; the single segment of the fifth foot with three equal spines; egg-sacs oval, as long as the abdomen; eggs few, dark; caudal stylets very long and slender, spined along the outer margin; lateral setæ small and approximated to the upper one; outer terminal seta short, spine-like, in life set nearly at right angles to the others, spined or beaded on one margin and bristled on the other; the next seta is as long as the abdomen, being somewhat exceeded by the following one; inner seta as long as the outer, but feeble; upper seta nearly as long, approximated; length less than 1 mm.

A well marked variety of the above occurs in America, which might rank as a species, were it not probable that it is simply a post-imago form occurring only under favoring circumstances. This variety has no connection with Brady's var. montanus.

Cyclops serrulatus, var. elegans. (Var. n.)

Distinguished from the type by the greater size, and the elongation of antennæ and caudal stylets. We will first of all give the measurements which afford a criterion for judging of the form and proportions.

Total length 1.34 mm.; thorax 0.76 mm.; abdomen 0.40 mm.; stylets 0.18 mm.; greatest width 0.42 mm.; inner median caudal seta 0.60 mm.; outer median seta 0.36 mm.; inner seta 0.08 mm. The first segment of the thorax is long proportionally (0.40 mm.) The antennæ are very long, reaching to the base of the third segment (.68 mm.). The egg-sacs are elongate-oval, being more slender even than in typical C. serrulatus; in the animal measured they were 0.50 mm. long, by 0.19 mm. wide. The caudal stylets are slightly shorter than the last two segments of the abdomen. The antennules are very short, and each joint has its series of fine teeth. The free lower margins of the thorax are ornamented with series of prominences, while the last segment is extended into a blunt angle bearing long teeth. The last segment of the abdomen is spiny-margined and is ornamented with a double row of spines at the anus. The armature of the stylets as well as that of the feet is identical with that in typical C. serrulatus. The last two joints of the antennæ measure 0.1 mm. each, while the two previous measure unitedly 0.12 mm. The color is not opaque as in the smaller form usually. Brady's var. montanus has shorter stylets than the type, but seems nearest the small dark form found in peaty waters in America. Cyclops pectinifer, Cragin, has no distinctive points, it being typical C. serrulatus.

Sp. 25. Cyclops macrurus, Sars.

Cyclops macrurus, BRADY.

Closely allied with C. serrulatus. Cephalothorax ovate, rounded anteriorly; last segment fringed at the angles with numerou hairs. Antennæ much shorter than in C. serrulatus, about as as the first thoracic segment, otherwise similar. Abdomen at ated, penultimate segment margined posteriorly with spin setæ, the other segments pectinated. Caudal stylets very lon slender, about equal in length to the three segments prece bearing a group of four to five spines on the outside near th otherwise unarmed. Length 1.3 mm.

Here is the natural place for C. spinulosus, of Claus, but th strong reason to suspect the validity of the species so very i fectly characterized.

Sp. 26. Cyclops fluviatilis, Herrick.

(Plate Q^5. Figs. 1—9.)

Cyclops magnoctavus, CRAGIN.

This small species with twelve-jointed antennæ and conspi coloration is widely distributed through the Mississippi valley. original description is appended.

"Body elongated; thorax very long; abdomen slender; s about as long or longer than last abdominal segment; setæ al short, not [always] pectinate; lateral and dorsal setæ very s outer one spine-like, short and stout; two median setæ short; one very small and inconspicuous; antennæ reaching nearly base of abdomen [or beyond]; formula –⏓⏑–⏓–––––––– three joints following the six basal are much elongated, whil terminal ones are but moderately so, a character which is pe to this species; terminal segment slightly but evidently hinge together with pair preceding, somewhat curved; feet with th minal spines strongly toothed; fifth foot very small, one-jo bearing three small setæ; operculum vulvæ heart-shaped; eg sub-quadrangular; eggs large; abdomen in the young elongated. Color deep indigo. Length 0.7 mm."

The first foot has upon the last joint of outer ramus thr ternal spines, two apical setæ and three internal setæ; the branch of fourth foot has three external spines, apically a spi seta and internally four setæ.

Males of this species are slender, measuring about 0.75 mm abdomen being 0.28 mm., stylets 0.6 mm., first thoracic se 0.28 mm., and the longest caudal seta 0.24 mm. The antenn long and much modified so as to resemble superficially the an of Diaptomus.

Antennæ 11-jointed.

Sp. 27. Cyclops diaphanus, Fischer.

(Plate R. Fig. 12.)

? *Cyclops bicolor*, SARS.
? *Cyclops minutus*, CLAUS, HELLER.

If not the young of other species, this is a widely distributed form, being known from Russia, Norway, continental Europe, Madeira, and America. The synonyms above given are upon the authority of Rehberg.

The following description applies to our American form found always in connection with C. thomasi, C. parcus, or C. navus.

Very small, measuring 0.81 mm., setæ not included. The thorax is 0.5 mm., the abdomen .31 mm., the stylets .06 mm., the longest caudal seta 0.4 mm., outer median seta .36 mm., the first thoracic segment 0.3 mm., and the egg-sacs sometimes 0.4 mm. The thorax is oval, the first segment being quite large, as in larval cyclops. The antennæ rarely reach the end of the first segment and are either 11-jointed or obscurely 12-jointed; their formula is —⏑—⏓⏑⏓———⏑⏓⏓. The first joint is very large.

The second antennæ are of rather small size; the maxillipeds are armed as in C. navus. The feet have usually but 2-jointed rami, but in large individuals some of the rami are obscurely 3-jointed. The first foot has the terminal joint of the outer ramus armed with three exterior spines, two terminal setæ and three interior setæ; the inner branch has one internal spine, a terminal spine and seta and three external setæ. The fourth foot has the terminal joint of the outer ramus with two external spines, a terminal spine and seta and four internal setæ; the inner ramus has one internal spine, two unequal spines and three internal setæ. There is also a series of teeth at the place where the middle joint should appear. The fifth foot consists of a broad, basal segment nearly fused with the abdomen and bearing laterally a long spine; the terminal segment is terete and small, having a single terminal spine. The caudal stylets are but little longer than the last abdominal segment, which bears teeth below; the sides are parallel, and the lateral seta is $\frac{2}{3}$ from base. The median setæ are long and toward the end show false jointing. The inner seta is longer than the outer which is, however, heavier. Eggs eight to twenty, in narrow elongate sacs. Not uncommon, everywhere.

Sp. 28. Cyclops phaleratus, Koch.

(Plate R. Figs. 6—10.)

(var. a.)
C. canthocarpoides, FISCHER, CLAUS, LUBBOCK, FRIC.
C. phaleratus, KOCH, SARS, ULJANIN, BRADY, REHBERG.
(var. b.)
C. affinis, SARS.
C. pygmæus, REHBERG.
C. adolescens, HERRICK.(=*C. perarmatus*, CRAGIN.)
?*C. lascivus*, POGGENPOL.

That the two varieties here united are very closely allied must be admitted; that they are merely age forms is possible. Claus in figure 2 of his plate II (Freilebenden Copepoden) figures some other species than the one described as C. cauthocarpoides, as can be gathered from the elongated stylets and the eight-jointed antennæ. Our Minnesota specimens combine the eleven-jointed antennæ of C. affinis with the short stylets and peculiar form of the fifth feet of the first mentioned. Rarely one is found with ten-jointed antennæ and at the same time sexually mature. The characteristic oblique lines of spines at the base of the stylets may be absent. Rehberg's figures of C. pygmæus agree very well with our species, but he has decided that it is not specifically distinct from C. affinis.

It appears to me undesirable to institute a new species for the American form, neither is it possible to sufficiently identify it with any of the above.

I here append a brief description of *Cyclops adolescens*, Herrick (=C. perarmatus, Cragin,) for comparison with the description of C. affinis as transcribed below. Thorax oval, broad, acute anteriorly; last segment large and separated by a constriction from the anterior ones. The head is beaked below; first throacic segment large and long (.36 mm.): last thoracic segment wide, united closely with the first abdominal segment, armed with series of teeth. Abdomen short, especially the last segment, which is toothed behind; stylets very short. The antennæ are much shorter than the first segment, eleven-jointed. The maxillipeds are very small. All the feet are armed with a row of very large teeth or lanceolate spines down one side; fifth foot one-jointed, with three spines, the outer being smooth, the others spiny; egg-sacs variable, narrow, appressed; eggs large, color usually dark. The animal moves like Canthocamptus, and is able to progress out of water better than other species. The following measurements will give an idea of the proportions: Length 1.26 mm.; thorax, 0.76

mm.; abdomen, 0.44 mm.; stylets, .06 mm.; longest seta, 0.34 mm.; antennæ, 0.28 mm.; width of thorax, 0.44 mm.

Cyclops affinis, Sars.

> "Antecedenti [C. phalerato] simillimus. Corpus autem minus robustum colore cœruleo vel potius glauco sat saturato insigne. Segmentum ultimum thoracicum ad marginem posteriorem extrosum pilis vel spinulis subtilissimis peetenatim exornatum. Rami caudales quam in C. phalerato aliquanto longiores, setarum apicalium interna quam externa multo breviore, intermediarum interiore altera fere triplo longiore longitudinemque abdominis superante, in medio aculeata dein vero subtile ciliata. Antennæ 1-mi paris segmento 1-mo corporis multo breviores, tenues, articulis 11 compositæ. Pedes 5-ti paris distincti, uniarticulati, setis 3, quarum interior ceteris multo major et ciliata, instructi. Sacci oviferi parvi abdomini appressi. Longit. circit. ½ mm."

Cyclops ornatus, Poggenpol (=*C. clausii*, Heller, fide Rehberg,) is almost certainly, in our judgment, a young or atavic condition.

C. helleri, Brady, though not identical, is no more worthy a specific name. If every form with eleven-jointed antennæ and egg-sacs be worthy a distinct name, it will be possible to duplicate all the seventeen-jointed forms. Fortunately, however, many species agree together in this condition, so that the number of spurious species derived from this source is rather small; among these is to be reckoned *C. nanus*, Sars, which is obviously very near the pulchellus group.

Antennæ 10-jointed.

No valid species have permanently 10-jointed antennæ. C. phaleratus is frequently found with 10-jointed antennæ. C. kaufmanni is without much doubt an immature form.

Antennæ 8-jointed.

Sp. 29. **Cyclops fimbriatus**, Fischer (fide Rehberg.)

(Plate R. Fig. 11.)

C. crassicornis, SARS, BRADY, HERRICK.
C. gredleri, HELLER.
C. pauper, FRIC.
C. poppei, REHBERG.
(? *C. magniceps*, LILLJEBORG.)

Our American species corresponds to that described by Rehberg as a new species. The differences mentioned in the previous report (see Cyclopidæ of Minnesota, p. 233) are just those which have led Rehberg to establish the C. poppei, which, by the way, was found with the type. I see no reason, especially in view of the latter fact, to regard it as even a well marked variety.

C. crassicornis is widely distributed in America as well as Europe, but is never very common. The color is always reddish.

Antennæ 6-jointed.

Sp 30. Cyclops æquoreus, Fischer.

A brackish-water species, .85 mm. long, which in a number of characters departs from the type of the genus. Those who have the opportunity to search the brackish pools along our coast would do science a service by looking for this interesting species.

NOTE.—Cyclops navicularis, *Say*, is perhaps C. viridis of this report. C. setosus, *Haldeman*, (Phila. Acad. Sci., Vol. VIII, p. 331) is referred in my notes to C. serrulatus, I do not now know with how much reason.

The reader is referred also to *Cyclops latissimus*, Poggenpol, as quoted by Cragin-which, although belonging to the section having seventeen-jointed antennæ, and having feet like C. tenuicornis, is said to have a disc-like body, long-jointed antennules with no armature, and the basal joint of the abdomen very long.

Cyclops ornatus is quoted by Cragin, but we are left in doubt as to the number of segments in the antennæ, a point quite essential to the definition of species.

(See under C. phaleratus.)

Cyclops longicaudatus and *C. igneus* are thought to be simply prematurely gravid young of known species.

(See Cragin, l. c., (pp. 12—13.)

Cyclops fischeri of the same author agrees with C. æquoreus in having six-jointed an, tennæ, but in nothing else apparently. It is, if correctly described, a very remarkable form, with no setæ on the antennæ.

FAMILY HARPACTICIDÆ.

Numerically the largest of the families of the Copepoda, this group contains predominatingly marine and mostly minute animals, frequently of strange and grotesque form. A few of the marine forms, inhabiting the gulf of Mexico, are figured in the report of the Minnesota Academy of Sciences for 1881. Of the over thirty genera of the family less than a half dozen are not exclusively marine, and of these most are brackish-water residents. The genus Bradya contains blind copepods living in slime.

The name was proposed by Dana, but was dropped in the final report. Again revived by Claus, it is now in use by the best authors. The general form and structure closely resembles that of the Cyclopidæ. The following characters are the more important ones in distinguishing the family from the other families of the order:

THE SUB-FAMILY CANTHOCAMPTIN

to which our sole genus belongs, is further distin
other sub-families of Harpacticidæ by the fact
maxilliped has a prehensile hook. The feet of
clawed, but have the inner branch elongated, an
mandible is one-branched.

GENUS CANTHOCAMPTUS, Westwo

These little animals may be secured in consider
gathering a supply of water from among weeds i
and permitting the debris to settle in a spot
touches the jar from one side, when the Canthoc
on the exposed side.

Canthocamptus is an elongated animal, with
rather obscurely into two portions, of which the
portion, is largest. This part of the body has fiv
of which has at least one pair of appendages. Th
of the head proper with one of the somites of th
as is discovered by observing that a pair of legs is
the largest segment of the body.

As seen from above, it is triangular and exten
short, stout beak or snout, like the rostrum of a c
the beak, in the center of the forehead, is the e
pigment and two lenses, showing that we really

covered with hairs. The fourth joint is more slender than the preceding, and terminates in a process below, which bears besides a long hair a peculiar blunt bristle, that serves some unknown purpose—probably being sensory in function like the similar hairs on the antennæ of some Cladoceræ. The next joint is shorter than the rest, while the remaining three are spined at definite points. The antennæ of the male are curiously altered, or *geniculate*, on both sides, as in Cyclops. The three basal joints are shortened, while more or fewer of the following ones are coalescent, followed by a hinge joint and two elongated segments.

The second antennæ or antennules are two-jointed, and the basal joint has a two-jointed branch or palp; the terminal joint is covered with spines; at the end are longer and curved spines, jointed in the middle.

The mandible is a flattened plate with digitate teeth at the end, on one side of which springs a two-jointed palp, and from the other a blunt process. The maxilla is somewhat like it, but has rudiments of other elements.

The first pair of feet have two three-jointed rami. The outer ramus is shorter and with the longer branch is directed forward. The fourth foot has the inner branch two-jointed. The inner branch of the third foot of the male is peculiarly modified to form a prehensile organ, as it is this foot which fastens the spermatophore to the female. The fifth feet are composed of two flat plates.

The second division of the body, the abdomen, consists of five segments, of which, however, the first two are united in the female. The last segment of the abdomen bears two stylets, which are sometimes considered as together constituting an additional segment. Each of these stylets has, with several small spines, two elongated caudal setæ, one of which is usually as long or longer than the entire abdomen. The stylets are usually considerably longer than wide, but the proportions vary somewhat in different species.

Viscera. The body cavity is traversed by the alimentary canal, which is a straight tube with no lateral cæca or blind sacs, as in some other Copepoda. The canal is divided into four more or less distinct portions; the first section is a slender, muscular tube, extending from the mandibles nearly through the first segment, opening into the stomach proper, which is a muscular and glandular sac, or tube, filling the greater part of the thorax ; at the beginning of the abdomen, the sac is constricted and becomes the intestine proper ; near the extremity again there is another change and the intestine loses its glandular character, and, by a peculiar adaptation becomes a sort of force-pump, which, during life, is constantly pumping water in and out, serving as a means of respiration. This anal respiration is quite common among aquatic animals in this as well as other orders. This latter section of the canal is the rectum, and opens beneath a toothed anal plate, above and between the stylets. No special divarications or cæca are appended to the digestive tract, and the only other organ which is at all considered to belong to the alimentary system, is what is known as the "shell-gland," present in most crustacea, but till recently thought to be absent in Canthocamptus. It is a coiled tube found in the lower part of the first segment of the thorax. It is impossible to find this organ in Canthocamptus, in every case, it being very obscure; and its office is uncertain, though it is supposed, perhaps with little reason, to be hepatic in function.

There is no functional heart in this animal, but its place is taken by a peculiar apparatus, hitherto undescribed ; this consists of a tube, surrounding the posterior portion of the alimentary canal. This sac around a sac is open in front, and serves by a double mechanism the office of a pulsating heart, though in a very imperfect manner.

There are no true hæmatic or lymph corpuscles in this animal ; so far, at least, none have been discovered. The place of these blood corpuscles is taken by globules of yellowish or red color of the most diverse size. These nutritive globules, or fat globules, as they have been called, are undoubtedly reservoirs of nutriment in a shape convenient for the animal's use, and equally certainly are derived from the contents of the intestine. In those Copepoda which have a functional heart, it is open anteriorly into a general body-cavity in the same way as in this animal. That a portion of the vascular system should surround the alimentary canal, is no unexampled thing, for in *Daphnia* a large sinus embraces a portion of the canal. The same provision as this described in Canthocamptus occurs in the Cyclopidæ. The nutritive globules are often very large, and are frequently extremely abundant, especially in females soon to become gravid. Three-hundredths mm. is not a large measurement for the diameter of such drops.

The nervous system is very hard to trace, consisting of a large pear-shaped ganglion just below the eye, from which extend commissures around the œsophagus, connecting them with the ventral ganglia lying between the bases of the feet. The senses are not apparently well developed, for, excepting the eyes, we cannot locate with certainty the organs of any sense. There are, however, two spots which are evidently devoted to special sense: first, the processes on the fourth joint of the antennæ, which may be simply the seats of tactile sense, or may have nerves suitable for perceiving chemical stimuli; second, the area on the forehead bordered by a raised line and covered with little pits, each with a small bristle. The character of this organ can be but conjectured; it may be homologized with the frontal nervous organs of the Cladocera.

The sexual organs are quite extensively developed, and periodically obscure the remaining viscera. In the male the simple testis is situated in the second segment, and the single vas deferens after numerous windings through nearly the entire length of the body, opens at the base of the first abdominal segment under a spined plate. A part of the vas deferens is of a glandular character and secretes an elongate tube, the *spermatophore*, which serves to contain the spermatozoids, and is fastened by the male at the opening of the median pore of the female; on contact with the water this tube, which is at first soft, contracts and presses the contents into the opening of the female organs. So long is the vas deferens that as many as three spermatophores are sometimes seen in the body at once. The spermatozoids are very small. The geniculated male antennæ are used in grasping the setæ on the tail of the female, and the curiously modified inner branch of the third foot of the male may assist in fastening the spermatophore upon her body. The ovary occupies the same position as the testes, and the two ducts are coiled in the body from end to end, opening in the median pore behind the fifth pair of feet. When the eggs are ready to be laid, they are forced out, carrying with them a film of the secretion of the lower, glandular portion of the ducts, which is of a collodion-like consistency, and which forms the enclosing sac. The young become fully developed sexually before they assume their final form, and it is not unusual to find ova-bearing females which are not only much smaller than the parent, but with considerable differences in the various organs.

This sort of heterogenesis is not uncommon among lower crustacea, for the young may differ much from the mother till after they have themselves produced young.

Four species have been recognized in America, of which one is certainly identical with a widely distributed European form, and a second is probably identical with an English species. C. palustris, Brady, seems to depart considerably from the norm of the genus and may prove a type of a marine genus. No true Canthocamptus is more than accidentally marine.

The ten species below enumerated are all that have fallen under the author's notice, though others may have been mentioned.

KEY TO THE GENUS CANTHOCAMPTUS,

- Inner ramus of 4th foot
  - 2-jointed.
    - In. ram. of 1st foot
      - 2-jointed.
        - 1 mm. long; basal joint of 5th foot small.....*C. gracilis*, Sars.
        - 0,5 mm. long; basal joint of 5th foot long. *C. brevipes*, Sars (?).
      - 3-jointed.
        - Inner ramus of 2d foot 2-jointed.
          - Antennæ thick ....*C crassus*, Sars.
          - Antennæ slender.
            - *C. trispinosus*, [1] Brady.
            - *C northumbricus*, Brady.
        - Inner ramus of 2d foot 3-jointed.
          - Stylets rather long. *C minutus*. Mueller.
          - Styl. short, oval, *C. illinoisensis*, Forbes
  - 3-jointed.
    - Male antenna normal ....*C. hibernicus*. Brady.
    - Male antenna reduced, hooked at the end ....*C.? palustris*, Brady.

Canthocamptus elegantulus, C. mareoticus and C. horridus are uncertain, probably referred to the wrong genus. C. stromii, Baird (= Dactylopus stromii,) C. rostratus, Claus (= Stenhelia ima.) C. virescens, C. linearis, and C. roseus of Dana, are marine Harpacticidæ of uncertain affinities. C. minutus of Claus is not sufficiently described, but appears to be the earlier condition of C. minutus, Mueller (C. staphynalis, Jurine).

Sp. 1. Canthocamptus gracilis, Sars,

Is elongated linear, with the abdominal segments smooth. Caudal stylets long and slender; external caudal seta about one-fourth the inner. All the feet with two-jointed inner rami; outer branch of fourth foot longer than the others, inflexed; basal process of fifth foot slightly expanded. Length 1 mm.

At Decatur, Alabama, was found a species of Canthocamptus which is different from any American species, and seems in many points nearest the above but, unfortunately, only a hasty sketch could be made at the time, and the notes are insufficient to define it. The form is not remarkably slender; the first and second abdominal segments are very large. The caudal stylets are slender and elongated, the inner seta being very long and curved, while the outer is quite short. The anal plate is covered with hairs only. The antennæ are normal, of moderate length, and the fifth foot has but a narrow process at the base.

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[1] Distinguished from the following by the presence of only three spines on the process of the basal joint of the fifth foot

If this form be worthy a distinctive name, it may be called

Sp. 2. Canthocamptus tenuicaudis. (Sp. n.)

(Plate O. Figs. 15 and 16.)

? Sp. 3. Canthocamptus brevipes, Sars.

This small form is almost certainly the young stage of some other species; yet I transcribe the description.

"Corporis forma et magnitudine C. pygmæo non dissimilis. Segmenta abdominalia vero postice magis attenuata seriebusque aculeorum destituta. Rami caudales elongati duplo longiores quam latiores, setis apicalibus brevisculis parumque divergentibus, exteriore dimidiam longitudinem interioris non attingente. Operculum anale absque dentibus. Antennæ 1-mi paris breves, articulis ultimis duobus in unum confluentibus articulum. Pedes natatorii brevissimi, ramo exteriore intus setis destituto, interiore biarticulato in pedibus 1-mi paris longitudinem exterioris æquante, in sequentibus multo breviore. Pedum 5-ti paris articulus basalis intus in processum foliiformem, sat magnum et angustatum, articulum ultimum elongato-ovatum aliquanto superantem, exit. Color albidus. Longit. parum supra ½ mm."

Sp. 4. Canthocamptus crassus, Sars.

Robust; segments margined with pectinate bristles. Caudal stylets oval, contorted, constricted at the base. Antennæ thick, densely covered with long setæ. Fifth feet with long setæ; basal process rather small. All the feet excepting the first, with bi-articulate inner rami. Length 0.75 mm.

Sp. 5. Canthocamptus trispinosus, Brady.

(Plate O. Figs. 6—14.)

This species with the last and next has all the feet save the first with bi-articulate inner rami. Very near the next, from which it differs in the form of the fifth foot of the female, which has the basal process smaller, bearing only three spines, while the next has six, the second joint being longer and narrow. The male is unknown. Not yet identified in America.

Sp. 6. Canthocamptus northumbricus, Brady.

Body robust; antennæ long as first segment, nine-jointed; mandibular palp minute. In the male the inner branch of the third foot is three-jointed and dactylate, as in C. minutus.

A well known species which has been frequently described and seems quite circumpolar in its distribution.

First mentioned from America in a paper by the writer in 1878. A pretty full description will also be found in the author's *Types of Animal Life*. A very abundant species, frequent in muddy pools, but somewhat variable in abundance. It may frequently be found in great numbers in winter.

Sp. 8. Canthocamptus illinoisensis, Forbes.

(Plate O. Figs. 1—5.)

This robust and pretty species was first taken near Minneapolis, by Mr. A. W. Jones, a student of the University, who found it in a peaty ditch. Forbes' description is appended.

"Length 1 mm. Head and first segment united; five abdominal segments in male, four in female. The suture between the first and second segments is not wholly obliterated above in the female.

Last abdominal segment is deeply and acutely emarginate. Branches of *furca* as wide as long, inner bristle plumose, a little longer than abdomen; outer plumose only on outer side, about half the length of the inner. The second to fifth *abdominal segments* have each a row of spinules along ventral portion of posterior.

Male with *anterior antennæ* composed of seven joints, the fourth joint very short. The front outer angle of the third is produced, the blunt process bearing three long bristles surrounding a slender olfactory club which is as long as the three following joints. The penultimate joint bears a strong spine or slender appressed process at the middle of its posterior margin. The five outer joints constitute the grasping organ. The *posterior antennæ* bear five long bristles at tip, three of which are made prehensile by the occurrence of from eight to twelve short articulations in the middle of the hair, allowing it to be bent forward. At the base of these articulations on the outer bristle, are two short spinules. Two nearly longitudinal rows of five or six strong, short spines each appear on the under surface of the outer joint of the antennule. The secondary flagellum, borne as usual on the middle of the basal joint, is not articulated, and bears four long bristles, two terminal and two on distal half of inner side. The outline of the *mandible* is exactly like that figured by Claus, but it bears about ten teeth, the upper thick and blunt, the inner sharp, slender and longer. Several are notched at tip. The lower angle bears a long simple bristle. *Mandibular palpus* two-jointed, second joint with three long terminal hairs and a shorter spine attached at basal third of anterior margin, jointed at base and directed towards tip, like a dactyl. The *maxilla* and *maxillary palpus* are scarcely to be distinguished from those of *C. staphylinus.*

The first maxillipeds are three-lobed, the outer lobe constituting a long, strong claw. The second and third are about one-third as long as the first, and bear each one strong simple spine and one weak branched hair. The inner lobe is widest, about two-thirds as wide as long. The dactyl of the *posterior maxilliped* is spinous on its inner edge, and the same edge of the hand is ciliate and bears a short, stout, sparingly plumose bristle at its base, just beyond the tip of the closed dactyl. The width of this joint (the second) is nearly half its length.

Basal joint of inner ramus of *first pair of legs* nearly or quite as long as outer ramus, the second wider but only half as long as the

A small species differing from all others save the next in having a three-jointed inner ramus of the fourth foot.

"Anterior antennæ of the female slender, 8-jointed, about as long as the first body segment, and much like that of C. minutus. Inner branch of the second antenna very small, 1-jointed. Posterior foot-jaw having a broad hand armed with a long apical claw. Inner branch of the first pair of feet scarcely twice as long as the outer; first joint longer than the entire outer branch, and nearly twice as long as the united second and third joints, both of which are extremely small. Inner branches of the second, third and fourth pairs shorter than the outer, and 3-jointed, the first joint

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* Evidently a misprint, for it is the inner ramus which is chelate.

being very small. Inner segment of the basal joint of the fifth pair of feet in the *female* elongated, fringed, bearing two long and three short apical setæ; second or outer joint sub-ovate, finely fringed internally; externally bearing six long marginal setæ. In the *male* the limb is smaller, the basal joint short, broad and having six short setæ of equal length; second joint nearly like that of the female. Caudal segments somewhat longer than broad; inner seta about twice as long as the outer; anal operculum denticulate. Length .65 mm." Not found in America.

Sp. 10. Canthocamptus palustris, Brady.

(Plate K. Fig. 5.)

A brackish-water species about .9 mm. long, found in a number of places in the British Isles. The species presents several anomalies.

The antennæ of the female are 8-jointed; those of the male robust, the last joint forming a hook. The first four pairs of feet have both branches 3-jointed; the fifth pair in the *female* are 2-jointed, with a short and broad basal joint, the second joint being sub-ovate, bearing five long apical setæ; in the male the fifth pair is obsolete, being reduced to a minute setiferous lobe. Caudal segments short, bearing two principal setæ, the outer half as long as the inner.

Sp. 11. Canthocamptus minnesotensis. (Sp. n.)

(Plate T. Figs. 1—6.)

Since the manuscript of this genus was finished, a small species has been found which seems undoubtedly distinct from any of the above. A single pair were taken in a gathering from Bassett's creek containing C. minutus in abundunce. Unfortunately the characters of the swimming feet are not certainly known, but they were apparently all three jointed save the last. The antennæ are very short and thick, 8-jointed, with a long flagellum; the antennules are of the usual form, and the mouth parts rather large. The first pair of feet have the two rami of nearly equal length. The form is moderately elongate. The caudal stylets are very short, quadrate in outline and well armed with spines. The fifth foot of the female has four long and two short spines on the inner lamina, and the terminal joint has five unequal spines. In the male the fifth foot has two spines on the lamina and six on the second joint, [illegible] being a small bristle. The male antenna is of peculiar form. The teeth of the anal plate are large and emarginate (see fig. 4.) The swimming feet are all armed with very strong spines, aside from the usual quota of spines at the end of each joint. Length [illegible] mm.

NOTE. C. frontinalis, Rehberg. This author seems to have parted with his usual acumen in the remarks upon this species. After describing a Canthocamptus with the inner ramus of the first foot "reichlich doppelt so lang wie die beiden Grundglieder des Aussenastes," he draws a moral on the mutability of genera from the fact that Brady established the genus Attheyella 'auf grund der Eingliede des innenastes am fierten Fusspaare und einer derartigen Bildung des ersten Fusses, wie er bie C. frontinalis beschrieben ist.' Brady says (Brit. Copepoda, p. 58): "inner branch of first pair of feet scarcely at all elongated, and either 2- or 3-jointed," etc. The distinctive characters being the 2- or 3-jointed 2d and 3d feet and the 1-jointed inner ramus of the fourth foot, it is doubtful if C. frontinalis is really new.

II. GENUS ATTHEYELLA, Brady.

This genus, the diagnostic characters of which have been above indicated, contains three nominal species. It is quite difficult to say what differences exist between Sars' "*Canthocamptus*" *pygmæus* and *Attheyella spinosa*. Brady did not seem to recognize the fact that his diagnosis included that species. The third species is the blind *A. cyrptorum*, of Brady, which it is interesting to compare with the blind Bradya limicola of the coast of the gulf of Mexico.

PŒCILOSTOMATA.

This group, consisting of animals more or less like Cyclops in appearance, but, during part of their existence, semi-parasitic, has been very little studied in America. Most of the fresh-water species inhabit the gill-cavities of fishes. The gills of fishes should always be examined (if practicable, microscopically) for these interesting animals.

The mouth parts are greatly reduced and their homologies uncertain.

GENUS ERGASILUS, Nordmann.

Body shaped much as in Cyclops; anterior antennæ short; antennules in the female large, four-jointed, terminating in a strong claw. Mouth opening in the center of the very large head, which is not beaked in front. The mouth parts are inconspicuous, but the maxilliped is a stout organ terminating in a long claw. The three anterior pairs of feet are bi-ramose, and each ramus is three-jointed; the outer ramus of the fourth foot is two-jointed; the fifth pair is absent or rudimentary. The abdomen is four or five-jointed, and the stylets are rather short. Ova-sacs two, large.

Ergasilus depressus, Sars.

(See Forhandlinger i Videnskabs-Selskabet, 1862.)

The form figured in plate S., fig. 1, is known from a gathering taken under the same circumstances as Sars' specimens, and consisted only of males. The animal is very transparent with deep blue markings below, especially between the bases of the feet. Sars thinks the males are always free, while the females early retire to the gill-cavities of fishes. This species may be distinct from the Norwegian form, but there is no reason for declaring that it is so.

E. depressus is probably the young of the widely distributed E. sieboldii.

NOTE.—As the systematic part of this work draws to a close, a note is received from Prof. Birge, who was so kind as to glance through advance sheets of the portion upon Cladocera. Prof. Birge informs me that his *Scapholeberis nasuta* is the same as S. (Daphnia) aurita, Fischer, as published in 1849 in the *Bull. Naturforsch. Gesellsch. in Moscau,* Bd. 22. This paper I have not seen. At Prof. Birge's suggestion, then, read on page 43.

Sp. 4. **Scapholeberis aurita,** Fischer.

Daphnia aurita, FISCHER.
Scapholeberis nasuta, BIRGE.

COLLECTING, PRESERVATION AND MISCELLANEOUS NOTES.

The appliances employed in the capture and study of Entomostraca are, in the main, those employed by the student of aquatic vegetation. The first in order of importance is the hand-net and its accompaniment, long rubber boots, such as cover the entire leg being preferable. Thus equipped, the student can collect by far the greater number of fresh-water crustacea. The net is best made by obtaining an ordinary gaff or dipping net of extra strength but small size. If jointed, the ferrule must be unusually strong, not, indeed, because of the weight or activity of the prizes, but because it is often necessary to lift a net full of water, which is a greater strain than the strongest fish would produce in a net with open meshes. The ring of such a net is furnished with a medium-sized bag of some porous but still rather close fabric. The writer usually uses for this purpose the thinner variety of flour sacking. This material fulls a little when wet, and permits the water to pass rather too slowly, but this is a good fault. The net is used in shallow water and among weeds. After the net has been repeatedly filled and permitted to drain nearly empty, the bottom of the net is seized and the small remaining amount of water is thrown by a dexterous movement of the hand into a large-mouthed jar, several of which are needed. By this method the animals can be secured in any desired degree of concentration, so to speak, provided care is taken to avoid fouling the net with fine mud or debris. A single jar should usually contain only a gathering from a single locality. In case the collection is not to be examined at once, the gathering, which must now be quite free from admixture of mud and filth, is concentrated as much as possible, and then poured into a thin filter-paper or a thin muslin bag. When nearly dry, the funnel is held over a small bottle, an opening is made in the apex of the filter, and the contents washed through with slightly dilute glycerine. Soon after pure glycerine is added so as to bring up the whole to the required degre of concentration. A sufficiency must be used to well cover up the whole. In case of haste the end of the filter containing the gathering may be torn off and placed at once in a bottle of glycerine or alcohol.

For the collection of Cypridæ it is recommended to use a very thin fine net, and gather as much as possible of the finely comminuted debris which settles in weedy pools. Spread this material in shallow pans and in an hour or so skim the surface with a small spoon-like hand-net, and transfer with the addition of clear water to shallow porcelain plates. Such gatherings may contain Ilyocryptus, Monospilus, the hook-nosed Pleuroxids (=Percantha) and, perhaps, also species of Canthocamptus.

The entomostraca of the larger lakes must be sought by a different method. A net of larger size, and composed of very thin material is drawn after a boat which is kept moving in different parts of the lake. Such a net should be so weighted as to receive water from the surface as well as from several inches below it. The net is emptied occasionally with plenty of water into large bottles, which may preferably be placed in the dark if to be unexamined for some time. Water kept in the dark will preserve its animal life for a much longer time than if exposed to the sunlight.

A similar net may be placed in a rapid stream in such a way that it remains partly full, but does not overflow. The accumulations of a day may be thus gathered into little space. The faucets of the city water will frequently afford a good supply of animal life, and unfortunately in Minneapolis a rather large number of forms are worms of a suspicious and unpleasant appearance. It must be observed that for this purpose the faucet must be well open so that a good current is secured, otherwise most of the impurities will be dropped on the way. A friend mentioned that very little life was found in the city water after long and careful experiment, during which, however, a very small stream was allowed to trickle through the complicated set of graduated screens. But the writer at the same time secured a rather large supply both of entomostraca and vegetable forms by simply permitting the water from the hydrant faucet to flow with full head through a muslin net.

But our methods are not yet exhausted. The dipping bottle frequently brings up animals quite different from those collected by the towing net at the surface. This consists of a large bottle weighted by a suitable bit of lead or iron and fitted with a tight-fitting cork or wooden stopple. The stopple is attached to the line fastened at the neck of the bottle in such a way that a sudden twitch of the cord opens the bottle when it has sunk to the required depth. Another method, when one does not object to mingling forms from all depths, is to lower a net weighted with a heavy ring to the bottom, there agitating it slightly and drawing it vertically upward. This serves in a poor way in the place of a dredge and will secure a larger gathering than the dipping bottle, and is quite as easily rigged. The collections secured in either of the above ways are placed in large shallow porcelain plates and, the microscope being ready, the study may begin. With a rather large hand-magnifier, with which, however, the student will soon be able to dispense entirely, the various forms seen swimming or creeping or springing about are scanned, chiefly for the purpose of noting their motions. The little black, brown or yellow imps springing on the surface are rapidly skimmed off as hindrances, and (if the student is interested in the Poduræ) consigned to a bottle of spirits. Next a great Belostoma, Corixa, Water-skater, Ranatra, or Dysticus requires the same treatment. Perhaps a half dozen "whirligig-beetle" require more time to dispose of, and then a careful removal of the dragon-fly larvæ and "water-tigers" leaves the coast comparatively clear save for sand-fleas and dipterous larvæ which must be endured as necessary evils.

With a narrow slip of paper folded trough-wise the desired animal is captured by a quick movement and the water permitted to drain off, when the specimen is placed on the object-carrier, and a square cover glass, one corner of which has been armed with a bit of wax, is placed over the animal and then adjusted so as to give the requisite amount of pressure to quiet its restless motions. The slip of paper is, in every way, more convenient than a dipping tube and avoids flooding the object-carrier. With a half-inch objective and suitable eye-piece the whole animal is drawn in as natural a position as possible, either with the aid of a camera or free hand, by the assistance of careful measurements and a given scale. A one-fifth inch objective is now substituted and all possible details added. If any dissections are necessary, the cover glass may be removed, the slide placed upon a slip of black paper and the parts separated as far as possible by the aid of a watchmaker's glass or dissecting microscope.

Up to the present time almost the only reagent which could be employed for the instantaneous killing of Entomostraca with the body in its natural position and the preservation of the same was osmic acid, which partly on account of its expense, perhaps, seems rarely to find its way into our laboratories. And even this is but partially successful or causes such a dark color as to obscure what one most desires to see. The desideratum seems to have been supplied by the discovery of Prof. Hermann Fol that ferric perchloride produces not only an instantaneous death but a fixation of all the parts with very little coloration or shrinkage. The alcoholic solution is diluted to about 2 per cent. and applied to a small quantity of water in which the animal is swimming, or a more concentrate solution is added at once to the water of a vessel containing numerous Entomostraca. The water is poured off and the animals washed with alcohol of 70 per cent., to which a few drops of nitric acid may be added to remove the ferric salts. According to Fol, in transparent animals the appearance is very little changed by this process. Specimens thus prepared may be preserved in alcohol and afford preparations for making thin sections. They do not take color well, but may be stained with gallic acid without difficulty.

As a preservative, glycerine does admirably for Copepoda, but no known fluid works satisfactorily for the Cladocera unless after such treatment as above indicated. Sections may be made by imbedding in soap, but the tissues of the Cladocera are so delicate that the writer never succeeded in making permanent preparations of such sections. Either the alcohol or the balsam as it flows in almost inevitably disturbs the natural position. 50 grammes of soap are dissolved in 200 cu. cent. heated alcohol of 96 per cent. The soap should be shaved very thin. A shallow paper trough is prepared and filled with the still warm mixture, and the animal, which lies in concentrated alcohol, is transferred into the solution and agitated till its tissues are permeated with the soap. When cold, the bit of soap is cut into the required form and is ready to be placed in the microtome.

As a preservative medium for Copepoda, Carpenters' gelatine answers well. It consists of clarified gelatine, one ounce to six fluid dramchs of pure glycerine. The preparations mounted in this require no cement, as the gelatine is quite firm when cold.

The previous pages refer to the fresh-water crustacea simply and will give a tolerable idea of the variety exhibited in the fauna of the lakes and rivers of America. The majority of Copepoda are marine and the coasts of the United States will afford the student of marine entomostraca a rich harvest of curious forms. These animals are now being investigated, it is understood, by competent naturalists. In the meanwhile any notes may be of a temporary interest. The following jottings, which are the result of a few days stay on Mississippi sound, will give an idea of the fauna of the gulf of Mexico. They are extracted from a paper offered the Minnesota Academy of Natural Sciences.

FAMILY CALANIDÆ.

GENUS PSEUDO-DIAPTOMUS. (Gen. n.)

Resembling Metrida and Diaptomus; compactly framed; cephalothorax 6-jointed, last two segments coalescent above; head rounded in front, beaked; eye small; antennæ appearing 22-jointed in both sexes, longer than the thorax; the right male antennæ geniculate as in Diaptomus; antennules bi-ramose, both rami rather short, inner one seeming but two- or three-jointed; mandible ten-toothed; maxillipedes well developed; feet all bi-ramose save the last, both rami 3-jointed; first feet smaller; fifth feet with inner ramus obsolescent, in the male nearly as in Diaptomus, in the female rather slender, simple, three-jointed; abdomen in the female 3-jointed, in the male 5-jointed; stylets in the female longer; ova-sac single; spermatophore pear-shaped.

This genus is of unusual interest on account of its close approach to the fresh-water section of the family.

The spermatophore in this genus is large and swollen and, as seen through the body of the male, is liable to be mistaken for eggs.

Pseudo-diaptomus pelagicus. (Sp. n.)

Rather compact; thorax alike in the sexes, antennæ short, seeming 22-jointed; first foot small, both rami 3-jointed; fifth feet in the male with but small rudiments of the inner rami, basal portion heavily armed with short teeth, otherwise almost as in *Diaptomus*; fifth feet of female slender, alike; abdomen in male very slender, with short stylets armed with five terminal setæ and a series of bristles on the inner margins, distal margin of segments of abdomen toothed; a series of spines also ornaments the middle of the first segment below; abdomen of female short and very spiny, first joint thick, second slender, oblong, third joint short; length of abdomen supplemented by that of the elongated stylets, which are spinulous on their edges; ova-sac ovoid, eggs numerous; opening of operculum vulvæ with lateral projecting lips.

This species is ornamented with irregular markings of brownish color which give it a strange appearance not observed in any other copepod. The size is like *Temora velox*, which the female resembles a little, a resemblance enhanced by the elongated stylets. By some changes in the definitions of *Metrida* and *Pleuromma* these three genera could be united, but there would then be no valid excuse for not admitting *Diaptomus*, so that, on the whole, it may be well to let matters stand until we reach some better understanding of the natural generic affinities of these animals.

Habitat, Mississippi sound, gulf of Mexico.

GENUS DIAS, Lilljeborg.

Slender; cephalothorax very long, narrow in front; abdomen with five segments in the male, in the female with three; antennæ 20-jointed, nodose; secondary branch of antennules one-jointed, small; labrum large; posterior maxillipeds short; swimming feet with 2- and 3-jointed rami; fifth feet with a single ramus.

Dias longiremis, Lilljeborg ?

Unfortunately the gathering was insufficient to determine with certainty the identity of our species with the above, but the female agrees quite well; and those points in the young males seen

which could be compared with the descriptions of *D. longir*
were sufficiently concordant. This species ranges, in the eas
hemisphere, from the North sea to the Mediterranean, and c
be expected here. It is a very active animal and represents a
differentiated type.

GENUS TEMORA, Baird.

Elongate; thorax five-jointed, fourth and fifth segments clo
combined; abdomen with four segments in the male, thre
female; antennæ 24- or 25-jointed; right antenna of the
geniculate; mouth parts as in *Calanus;* inner branches of sec
third and fourth pairs of feet two-jointed, of first one- or two-join
fifth feet with but one branch, prehensile in the male.

Temora affinis, Poppe.

= *T. gracilis*, HERRICK, MS.

The shallow bays and estuaries along the Gulf of Mexico sw
with a species of Temora but little unlike *T. velox.*
The body is much less compact, it being rather slender in
sexes; in like manner the caudal stylets are very much elon
being nearly as long as in *T. longicornis* of Mueller, from whic
is clearly distinguished by many obvious characters, and w
seems to show an approach to *Metrida.*
The antennæ in male and female are just as in *T. velox*, and
fifth feet are little, if at all, dissimilar; the spine on the sec
joint in the female is not serrated, however, and the basal joi
the abdomen in this sex has three teeth on either side. The ca
stylets are about six times as long as broad in the female
densely spined, as is the last abdominal segment. The stylets
more slender in the male and have few spines, but the last abd
inal segment has three larger spines on either side. Inner ra
of the first foot one-jointed. The animal is generally colorles
autumn at least, but may be variously ornamented with prism
colors, the most constant of which markings are a band about
stylets and across the thorax and between the bases of the
The ova are very numerous and carried as in *Diaptomus.*
species is littoral in habitat and ranges from salt-water bays t
fresh waters of rivers, along with several varieties of *Cyc*
Sida, etc.

FAMILY HARPACTICIDÆ.

GENUS AMYONE, Claus.

Body much compressed; dorsal margin strongly curved; head very large, produced and angled below; antennæ 6- to 8-jointed; antennules palpate, 3-jointed; second maxillipeds long, chelate at the end; last thoracic and anterior abdominal segments enlarged; fifth feet leaf-like, large.

A very small crustacean, little over ½ mm. long, occurs in the gulf of Mexico in shallow water among vegetation. Insufficient material prevented its complete study, but it is nearly allied to *A. sphærica*, Claus, from which it differs in several particulars.

I can do no better than quote the remarks of Claus, the original discoverer of this peculiar genus.

"The body of this highly remarkable form, represents, in its general form, an intermediate stage between the nauplius (cyclops larvæ) and the mature copepods. The oval, almost spherical form, the slight development of the abdomen and the enlargement of the anterior thoracic segment recall the structure of the larva, while the almost complete segmentation of the body, the jointing of the antennæ and the swimming feet, as well as development of the reproductive organs, make the maturity of the creature certain." (Beitr. zur Kenntniss der Entomostraken.)

GENUS LAOPHONTE, Philippi.

Rather slender; antennæ 4-, 8-jointed; palp of antennules 1-jointed; mandibular palp 1- or -2-jointed; maxillæ palpate; first pair of feet slender, outer branch short, 3-jointed, inner branch elongated, 2-jointed; three following pairs with one ramus 3-, the other 2-jointed.

Laophonte similis, Claus?

The small crustacean which is referred to the above species occurs sparingly in the brackish waters of Mobile bay, and with *Temora* seems to be the only entomostracean not also found in the fresh waters adjacent.

From the few specimens found it could not be certainly determined that our species is identical with the European. The differences are, however, such as might be expected in immature specimens. Brady figures a similar reduction in the number of joints of the antennæ as that seen in our specimens. The fifth foot too, is less well armed with spines, but otherwise the agreement is tolerably close.

GENUS HARPACTICUS, Milne-Edwards.

Elongate or expanded laterally; head united with the first thoracic segment; first and second abdominal segments coalescent; antennæ 8-, 9-jointed; mandibular-palp 2-branched, large; second pair of maxillipeds strongly developed; outer ramus of the first pair of feet 2- or 3-jointed, inner ramus 2-jointed; first and second joints of outer ramus elongated, second joint of inner ramus short; both rami of following pairs of feet 3-jointed; ova-sac single.

Harpacticus chelifer, Mueller. (var. n. ?)

The species inhabiting the gulf of Mexico resembles *H. gracilis*, Claus, in the length of the setæ and some other peculiarities; but the antennary palp is more like *H. chelifer*, with which it closely agrees in most respects. Remembering that the entomostraca have their highest development in temperate and arctic regions, the small size and greater proportional length of setæ and stylets may be explained. *H. gracilis* from the Mediterranean takes the place of the true *H. chelifer* of the North sea, and is regarded by Brady as the same species. Our form would, in this case, stand more nearly related to the typical form. Both branches of the first feet are two-jointed and the antennary palp has three spines on its distal segment.

GENUS BRADYA, Boeck. (1872.)

Antennæ very short, 6-, 7-jointed; antennules of moderate size longer than antennæ, with a 2- or 3-jointed palp; mandibular palp large; maxillipeds rather large, outer branch (first foot-jaw of Brady?) much as in *Calanidæ*; first four pairs of feet nearly alike; fifth pair small, not lamellate.

This peculiar genus is not yet well circumscribed and defined, and it is much to be regretted that lack of time prevented from ascertaining how far the western species agrees with the generic characters of the European form and thus determining the validity of the assumed generic criteria. That our species is a member of the genus can not be doubted, but the hurried examination which could be devoted to it failed to cover the entire structure.

Bradya limicola. (Sp. n.)

Body flattened; free margins of the segments of the dorsal carapace rather long; little separation between abdomen and thorax; abdomen cylindrical, rather long; stylets short; distal margin of the segments spined; antennæ very short, 6- or 7-jointed, hardly longer than the movable beak; second antennæ much longer, 3-jointed; palp long, two-jointed; mandibles palpate, teeth fine, much as in Calanidæ; palp bi-ramose, second ramus very small; maxillæ of moderate size; maxillipeds large, outer one as in Calanidæ; first four pairs of feet bi-ramose, each ramus 3-jointed; fifth foot small, with two terminal digitate processes and a seta on either side. The male is at least a third smaller and has longer caudal stylets; the antennæ are modified, but very short. *The eyes are wanting in both sexes.* This very interesting species was collected in the brackish water of a ditch shaded by high sedges so that the sun could hardly penetrate. I did not find any representative of the genus in the open waters neighboring, but it is hardly to be doubted that such exist. This species is quite distinct from *Bradya typica* of north Europe.

The only other blind copepod with which I am familiar is *Attheyella*, which is circumstanced somewhat as the above.

The European *B. typica* is pelagic; ours dwells in darkened ditches and seems to furnish another illustration of the effects of seclusion upon the visual organs. Brady seems to have transposed the maxillipeds; these are really but branches of the same organ, as shown by the development, and the outer ramus is, probably, what Brady usually calls second foot-jaw but here first foot-jaw. In the characters of the mouth parts and fifth feet our species seems to show an affinity with the elongated higher copepoda.

Ocean Springs, Mississippi.

Caligus americanus, Dana and Pickering ?

A species of Caligus was collected at dusk far out in Mississippi sound in considerable numbers. The animals were floating in a bank of vegetation and swam freely. They seem not to differ greatly from the species described by Dana and Pickering in 1838 from the cod near New York. The fish lice are remarkable for their flattened bodies and the paired sucking organs on the head.

A species of Corycæus allied to *C. varius* of Dana was also collected.

Note.—Prof. Forbes, to whom advance sheets of the portion o Copepoda were sent, writes me that he somewhat questions th identity of the Minnesota species of Diaptomus referred to *leptopus* with the species for which that name was proposed. I d not know of any facts casting doubt upon the reference, but wi to call the reader's attention to the suggestion of Prof. Forbes.

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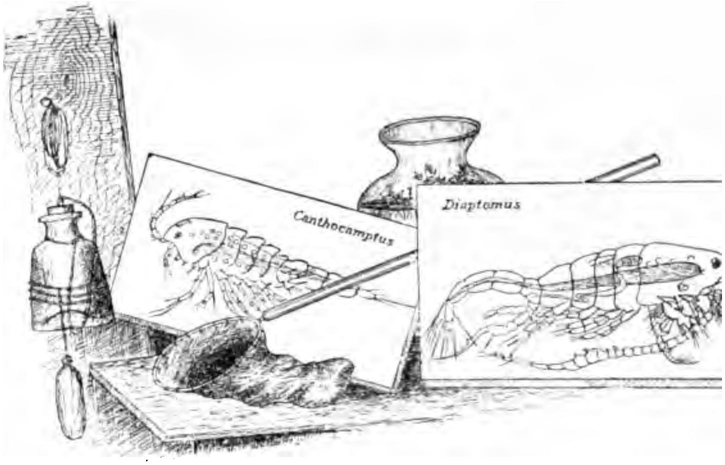
Canthocamptus
Diaptomus

PLATES OF PART V.

PLATE A.

Fig. 1. abdomen of *Moina paradoxa*, female, from Minnesota.

Fig. 1a. spine from post-abdomen.

Fig. 2. post-abdomen of *Moina rectirostris.*

Fig. 3. head of *M. paradoxa*, female, showing (a) eye with pigment and lenses, (b) supra-œsophagal ganglion, antennule with (c) its muscle, (d) its nerve, and (e) its terminal sensory filaments, (f) the cæcum of stomach, (g) optic ganglion, (h) stomach, (i) œsophagus, (j) the muscles which move the eye, also part of the labrum.

Fig. 4. antennæ of same.

Fig. 5. ephippium of *M. rectirostris.*

Fig. 6. . " of *M. paradoxa.*

Fig. 7. seminal cell of *M. paradoxa* ; 7a, a group less magnified.

Fig. 8. seminal cells of *M. rectirostris.*

Fig. 9. first foot of male of *M. paradoxa.*

Fig. 10. " " " " " *M. rectirostris* (from Weismann).

Fig. 11. male *M. rectirostris* (from Weismann).

Fig. 12. head of *Ceriodaphnia rotunda.* (This and the following numbers after P. E. Mueller.)

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12th Annual Report PLATE A. Geol. & Nat. Hist. Sur. Minn.

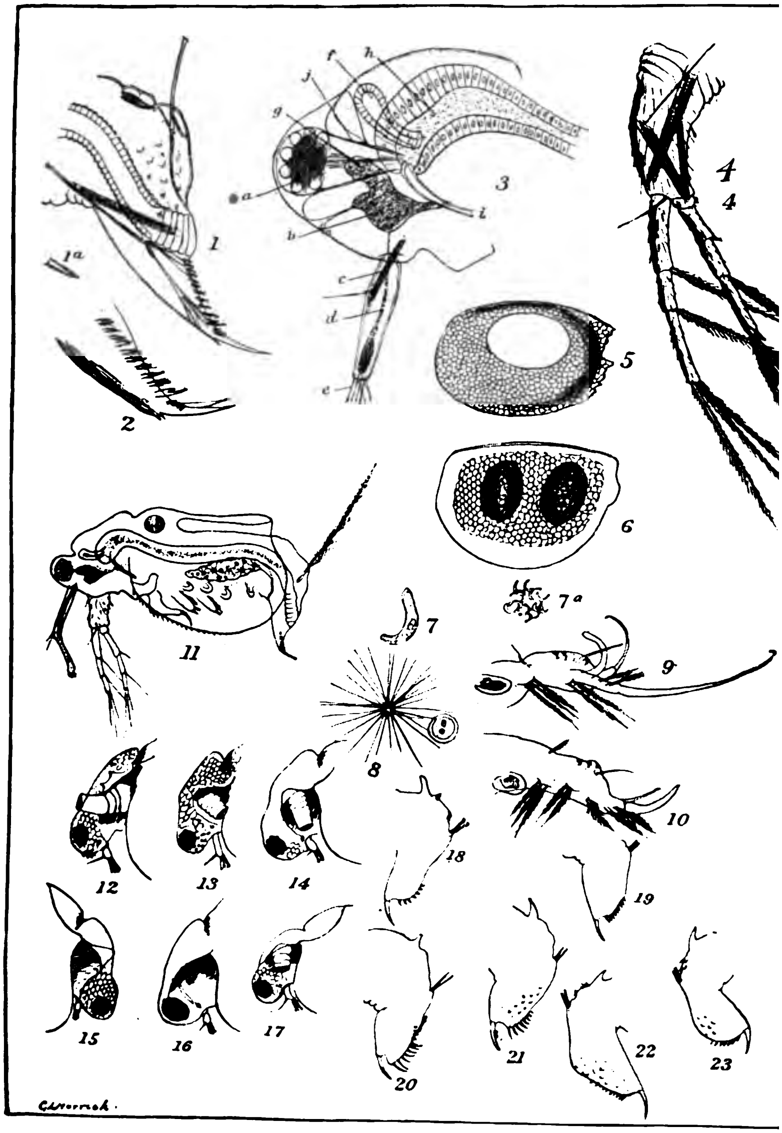

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Fig. 1. *Ceriodaphnia rotunda*, male (after Kurz).
Fig. 2. *C. alabamensis*. female.
Fig. 3. *C. reticulata*, post-abdomen of male with opening of vas deferens (after Weismann).
Fig. 4. *C. consors* ? ?
Fig. 5. *C. scitula*, head of female.
Fig. 6. do., post-abdomen.
Fig. 7. do., antennule of male.
Fig. 8. do., semen cell of male.
Fig. 9. *Scapholeberis angulata*, adult female; 9a. first foot.
Fig. 10. *Schapholeberis armata*, "
Fig. 11. do., view from below.
Fig. 12. *Lyncodaphnia macrothroides*, young.
Fig. 13. do., labrum.
Fig. 14. do., antennule.
Fig. 15. do., last foot, purple pigment in lower part.

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12th Annual Report *PLATE B.* *Geol. & Nat. Hist. Sur. Minn.*

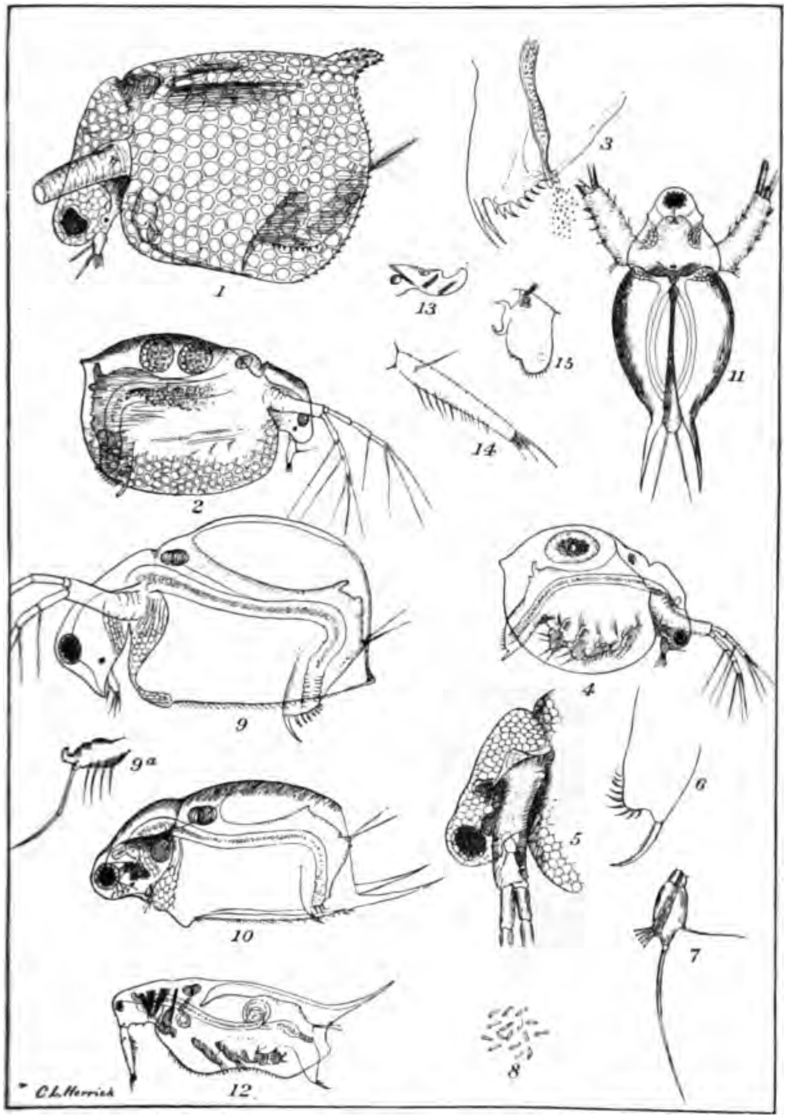

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Fig. 1. *Lyncodaphnia macrothroides* (= *Ofryoxus?*), adult female, showing coiled intestine, elevated anus, long antennules, elongated seta of second antennæ, anterior cæca, etc.
Fig. 2. post-abdomen of the same.
Fig. 3. antennule.
Figs. 4—6. *Polyphemus pediculus*, young and adult females.

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From the 10th Annual Report. PLATE B^{1}. *Geol. & Nat. Hist. S*

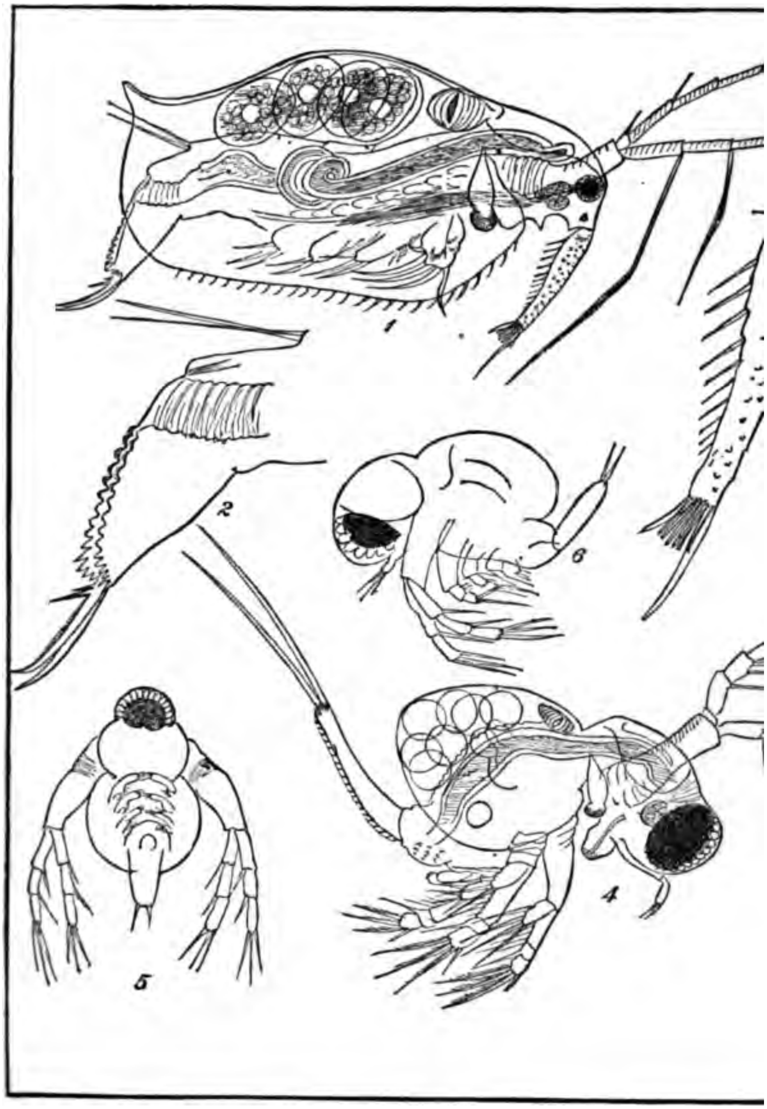

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Fig. 20. *Macrothrix tenuicornis*, heart and accompanying vessels.

Fig. 21. *Ilyocryptus spinifer*, post-abdomen.

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12th Annual Report PLATE C. Geol. & Nat. Hist. Sur. Minn.

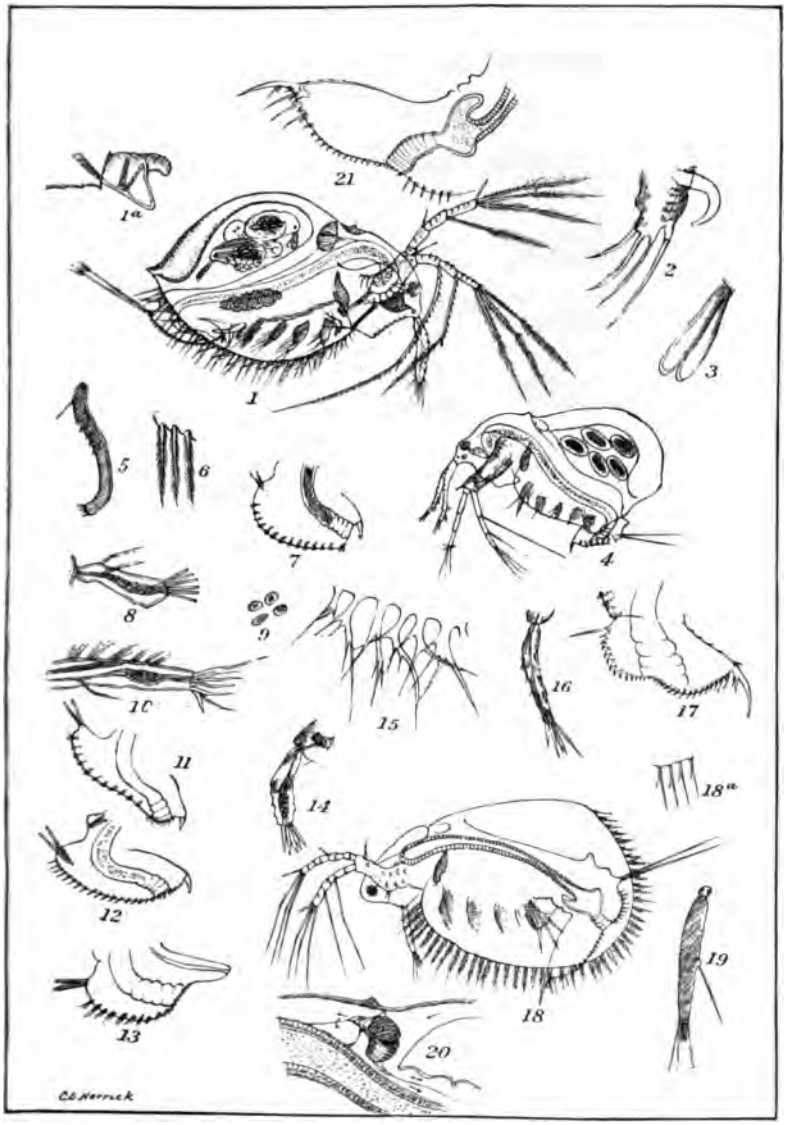

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Fig. 1. *Lathonura rectirostris.*
female, from above. a. eye. b. optic ganglion. c. muscles of eye. d. muscles of antenna. e. dorsal sucking disc. f. stomach. g. young in brood cavity.
Fig. 2. female, from side.
Fig. 3. head seen from below.
Fig. 4. maxillæ.
Fig. 5. first foot.
Fig. 6. ovary.
Fig. 7. antennule.
Fig. 8. last foot.

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12th Annual Report | PLATE D. | Geol. & Nat. Hist. Sur. Minn.

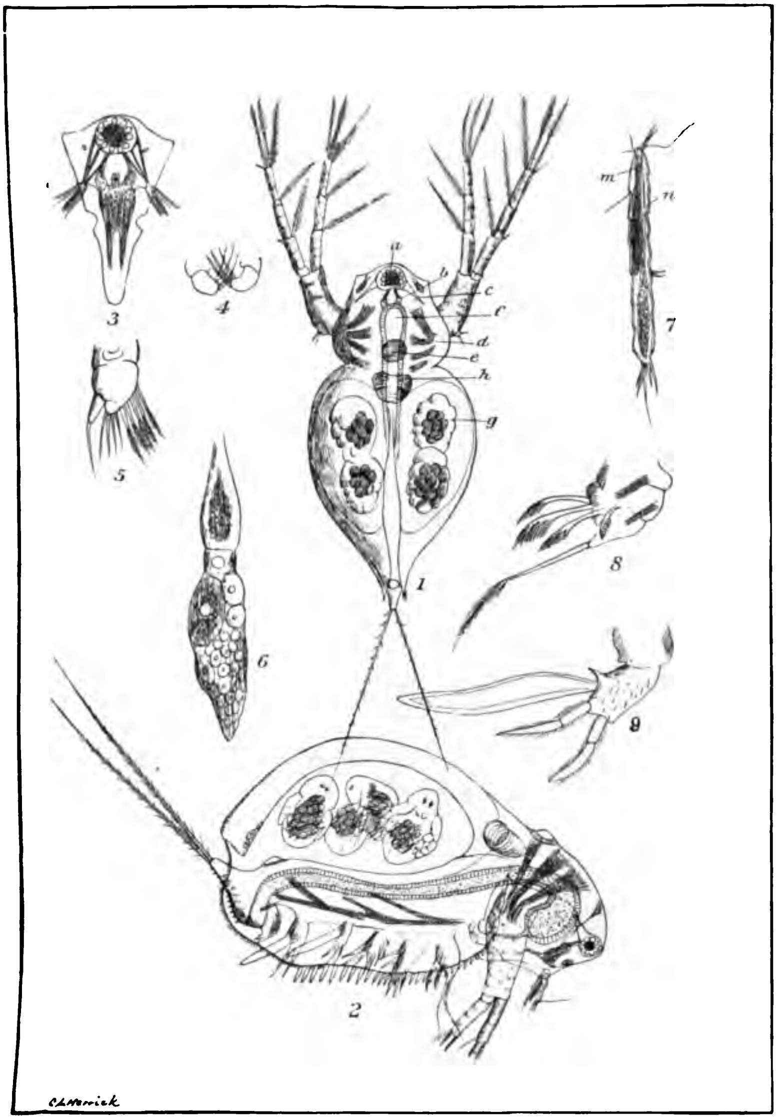

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Fig. 1. *Alona quadrangularis*, female.

A. antennule. Lb. labrum. Md. mandible. P-a. post-abdomen. An. anus. F. c. musculus flexor caudalis. E. c. musculus extensor caudalis. A. g. anal gland. n. g. nutritive globule in embryo. t. tail of embryo. I, II, III, IV, V. five pairs of feet of embryo. mx. maxilla of embryo. at^2. antennæ of embryo. at^1. antennules of embryo. H. heart. Sh. g. shell gland. Ov. ovary. Md. m. muscle of mandible. At.^{2} m. muscle of antennæ. E. eye. s. œ. g. supra-œsophagal ganglion. P. F. pigment fleck.

Fig. 2. brain, eye and pigment fleck of same.
Fig. 3. *Pleuroxus procurvus*, female.
Fig. 4. foot of same.
Fig. 5. *Acroperus leucocephalus*.
Fig. 6. *Alonella excisa*, female; 6a. shell of same.
Fig. 7. antennæ of same.
Fig. 8. *Alonopsis latissima*, female.
Fig. 9. *Alonopsis media*, female.
Fig. 10. *Camptocercus macrurus*, post-abdomen.
Fig. 10a. lower angle of shell of same.

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12th Annual Report PLATE E. Geol. & Nat. Hist. Sur. Minn.

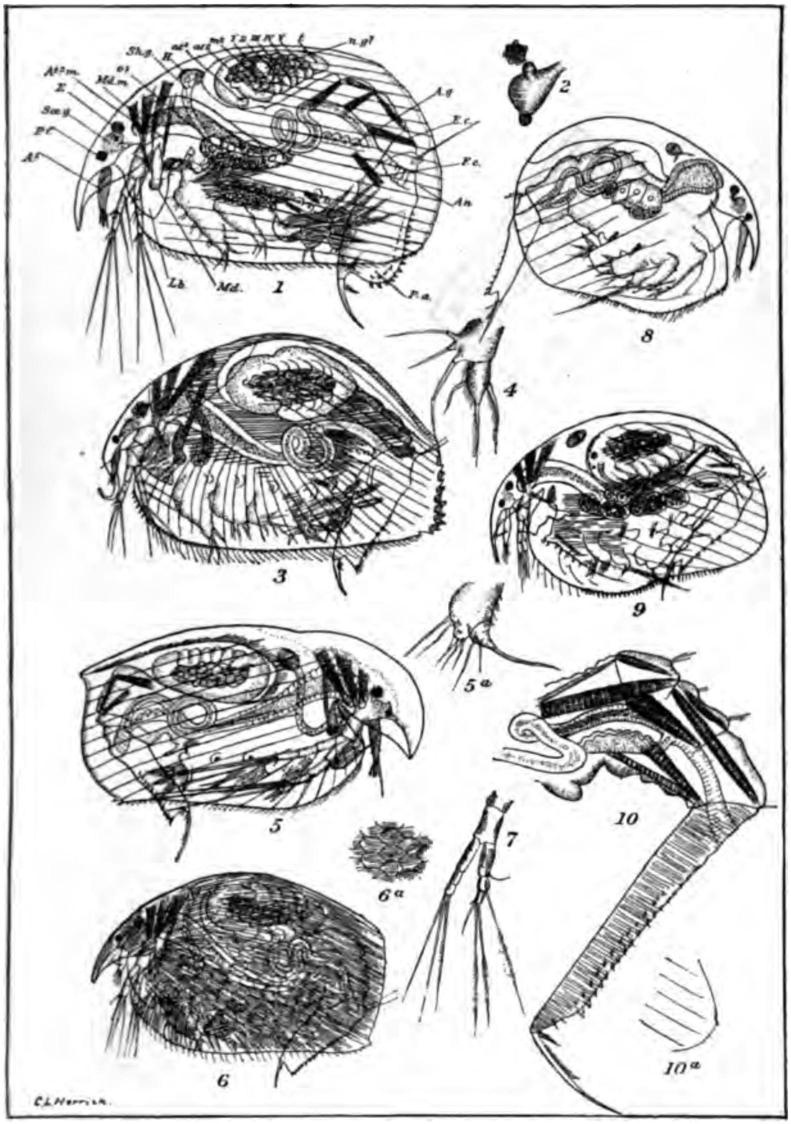

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Fig. 5. *Chydorus nitidus*, post-abdomen of female.
Fig. 6. *Chydorus nitidus*, head.
Fig. 7. *Chydorus sphæricus*, ephippial female.
Fig. 8. do., female.
Fig. 9. *Chydorus globosus*, post-abdomen of male.
Fig. 10. *Chydorus sphæricus*, from above.
Fig. 11. *Chydorus ovalis.*
Fig. 12. *Chydorus cælatus.*
Fig. 13. *Crepidocercus setiger.*
Fig. 14. *Alona affinis.*
Fig. 15. *Pleuroxus unidens*; 15a. antenna.

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PLATE F.

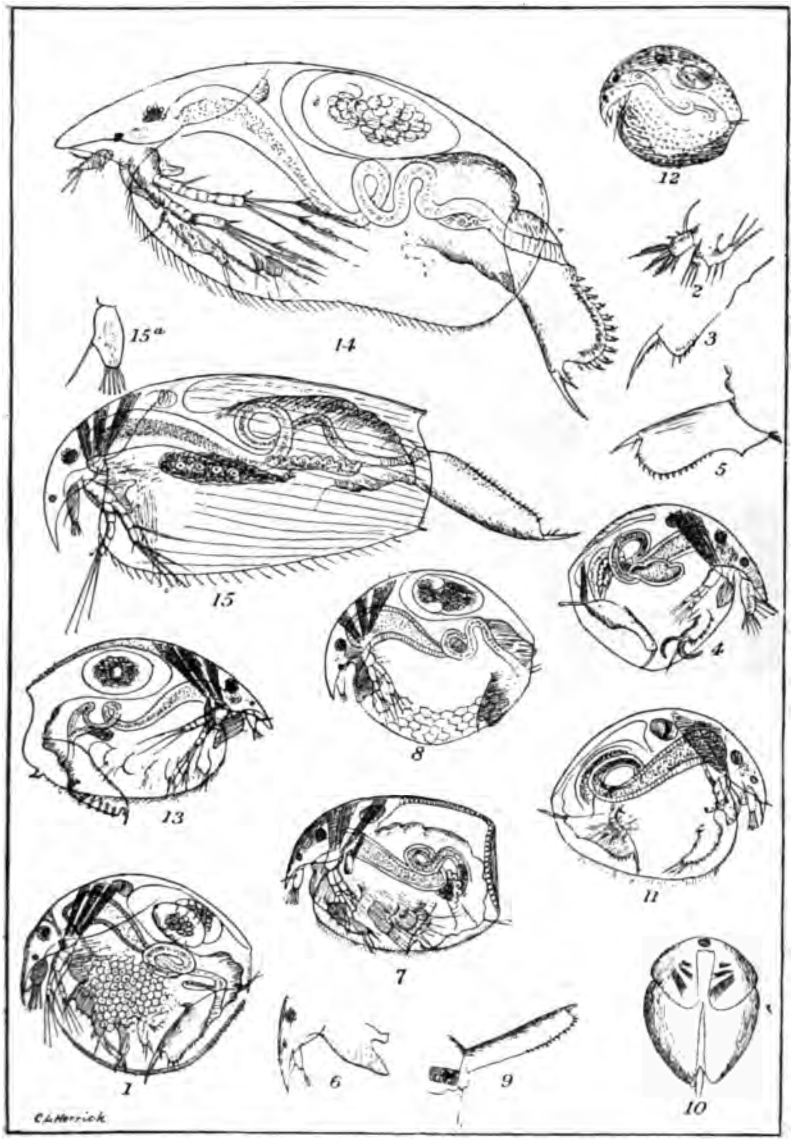

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Fig. 9. *Alonopsis latissima*, feet.

Figs.10, 11. *Alonella excisa*, details of shell sculpture.

Fig. 12. *Pleuroxus denticulatus*, female; 10a. outline of ephippium.

Fig. 13. do., common variety.

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12th Annual Report, PLATE G. Geol. & Nat. Hist. Sur. Minn.

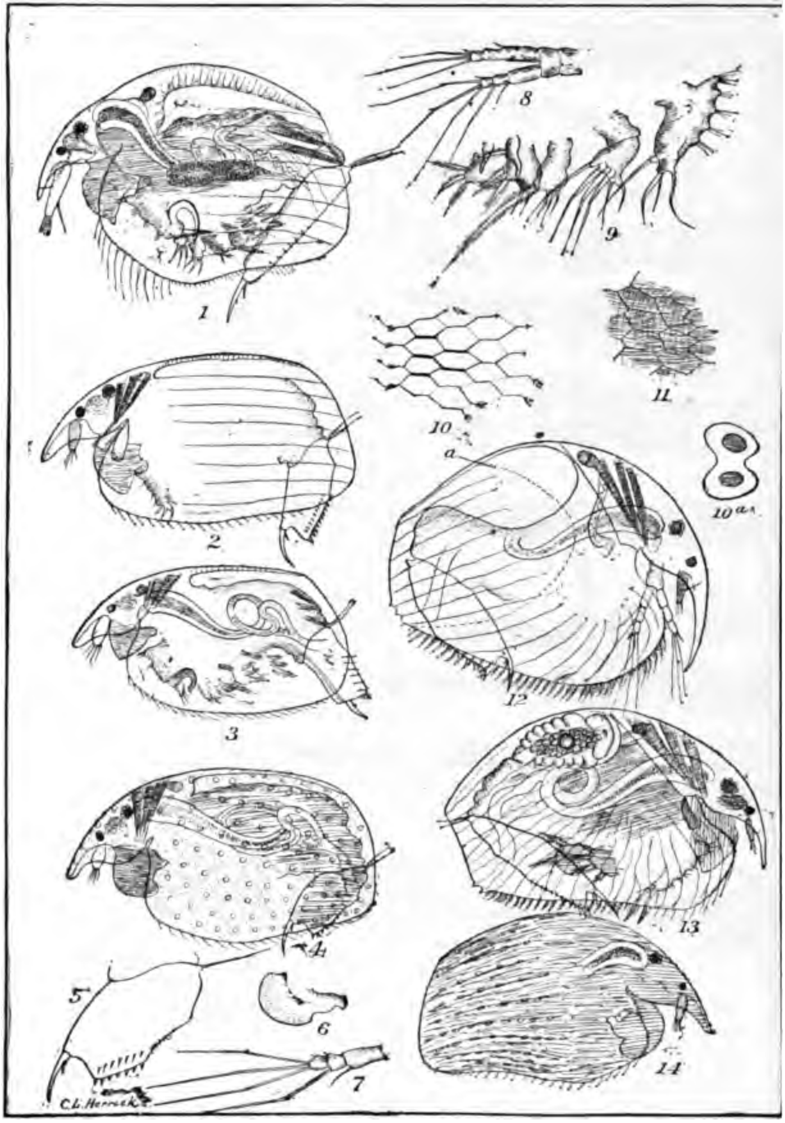

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Fig. 1. *Pleuroxus hamatus*, post-abdomen and ar
Fig. 2. *Pleuroxus affinis.*
Fig. 3. *Alona modesta* (= *lineata?*)
Fig. 4. *Leydigia quadrangularis.*
Fig. 5. *Eurycercus lamellatus*, male; 5a. posterior
Fig. 6. do, antenna of female.
Fig. 7. *Alonella pygmæa.*
Fig. 8. *Temora affinis*, Poppe. female.
Fig. 9. do., abdomen of female.
Fig. 10. do., male.
Fig. 11. do., abdomen of male.
Fig. 12. do., fifth feet of male.
Fig. 13. do., " " of female.
Fig. 14. do., jaw.
Fig. 15. do., antennule.
Fig. 16. Nauplius larva of this or a related species.

MINNESOTA CRUSTACEA

15th Annual Report — PLATE H. — Geol. & Nat. Hist. Sur. Minn.

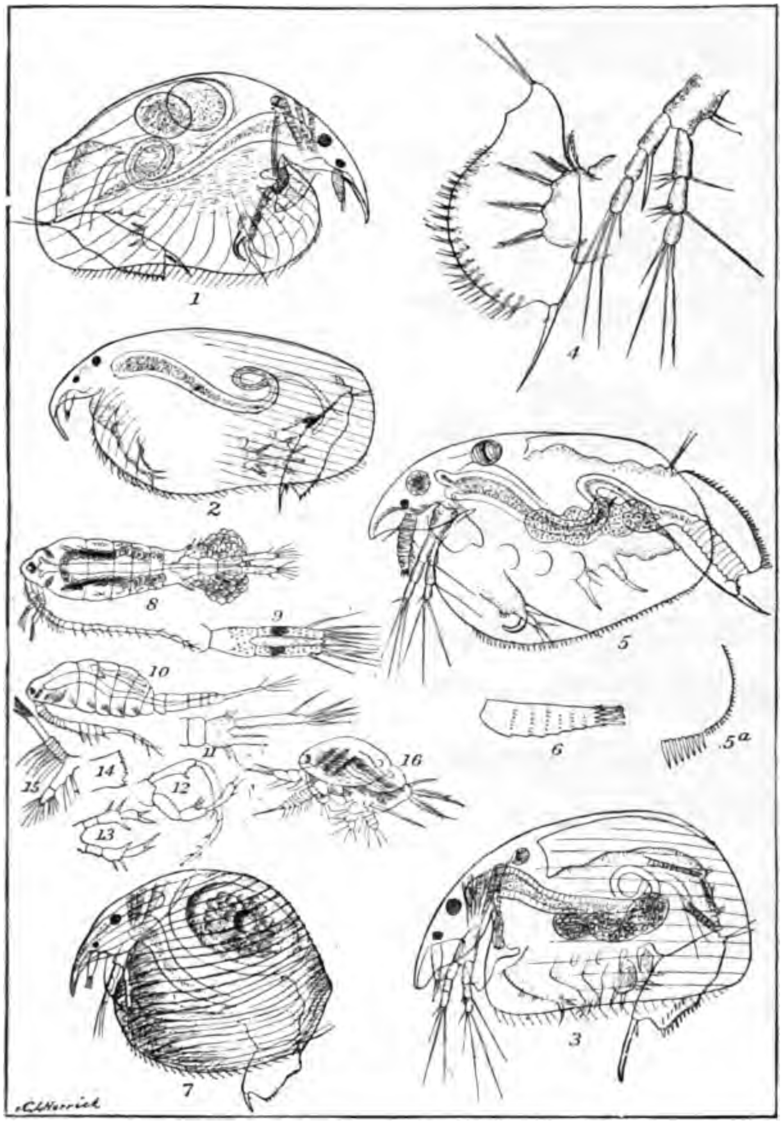

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Fig. 1. *Camptocercus rectirostris*, post-abdomen of female.
Fig. 2. do. post-abdomen of male.
Fig. 3. do. male.
Fig. 4. *Camptocercus biserratus*, head.
Fig. 5. *Camptocercus latirostris*, head of male.
Fig. 6. do., head of female.
Fig. 7. *Camptocercus lilljeborgii*, head.
Fig. 8. do., post-abdomen of female.
Fig. 9. *Acroperus leucocephalus*, post-abdomen of male.
Fig. 10. *Acroperus angustatus*, " "
Fig. 11. *Alona tenuicaudis*, post-abdomen.
Fig. 12. *Alona dentata*, post-abdomen.
Fig. 13. do. female.
Fig. 14. *Alona elegans*.
Fig. 15. *Alona intermedia*.
Fig. 16. *Pleuroxus hastatus*.
Fig. 17. *Leptorhynchus falcatus*.
Fig. 18. *Phrixura rectirostris*.
Fig. 19. *Eurycercus lamellatus*, first foot of female.
Fig. 20. *Alona sanguinea?* shell markings.
Fig. 21. *Monospilus dispar*; 21a. do., head seen from in front.

Figures 19-21 original, others from Kurz, P. E. Mueller and Schoedler.

MINNESOTA CRUSTACEA.

9th Annual Report — *PLATE I.* — *Geol. & Nat. Hist. Sur. Minn.*

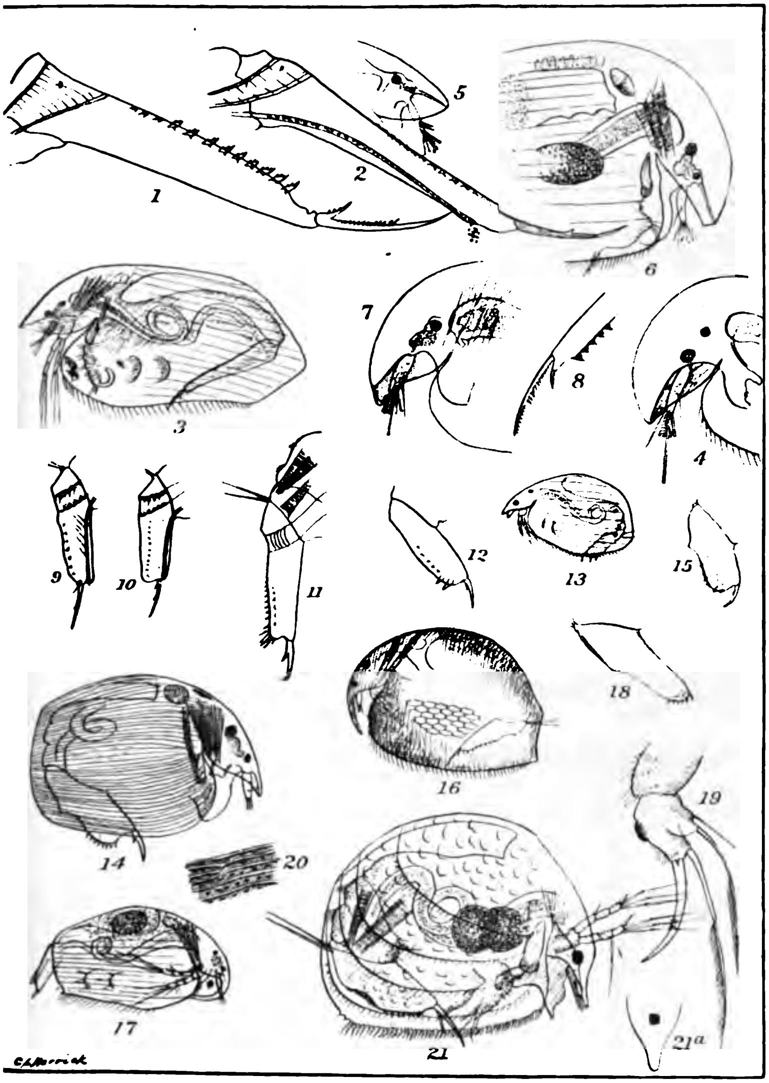

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PLATE J.

Fig. 1. *Ceriodaphnia scitula*, (small var.) ephippial female.
Fig. 2. *Bosmina longirostris.*
Fig. 3. *Bosmina lilljeborgii.* After P. E. Mueller.
Fig. 4. *Bosmina*, hook on the first foot of male.
Fig. 5. *Scapholeberis mucronata.*
Fig. 6. *Scapholeberis cornuta*, head.
Fig. 7. *Scapholeberis angulata*, head; 7a. angle of shell.
Fig. 8. *Pleuroxus denticulatus*, male.
Fig. 9. *Simocephalus americanus*, head of female.
Fig. 10. *Bosmina*, post-abdomen of male (after Weismann).

MINNESOTA CRUSTACEA.

PLATE J.

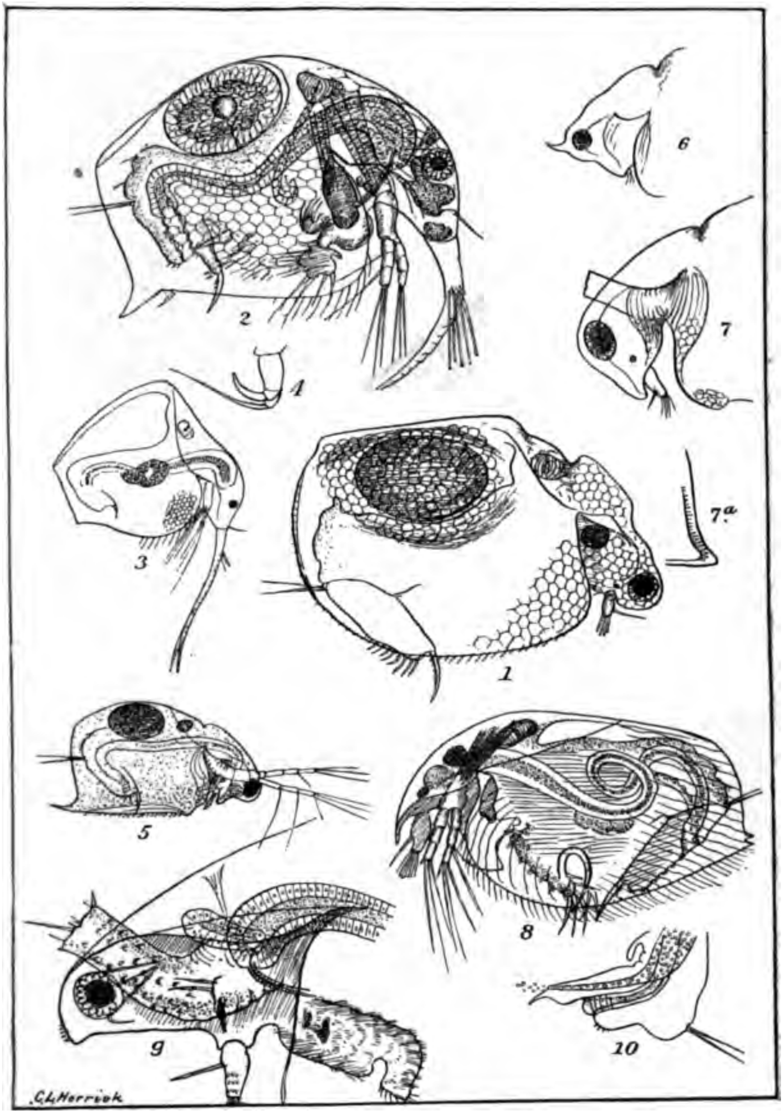

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PLATE J1.

Fig. 1. *Bosmina striata.*
Fig. 2. *Bosmina longirostris.* (See plate J, fig. 2.)
Figs. 3-5. *Bosmina cornuta.*
Figs. 6, 7. *Pleuroxus procurvatus.*
Fig. 8. *Graptoleberis inermis.*
Fig. 10. *Acroperus* sp.
Figs. 11, 12. *Graptoleberis inermis.*

MINNESOTA CRUSTACEA.

From the 10th Annual Report. PLATE J 1. *Geol. & Nat. Hist. Sur.*

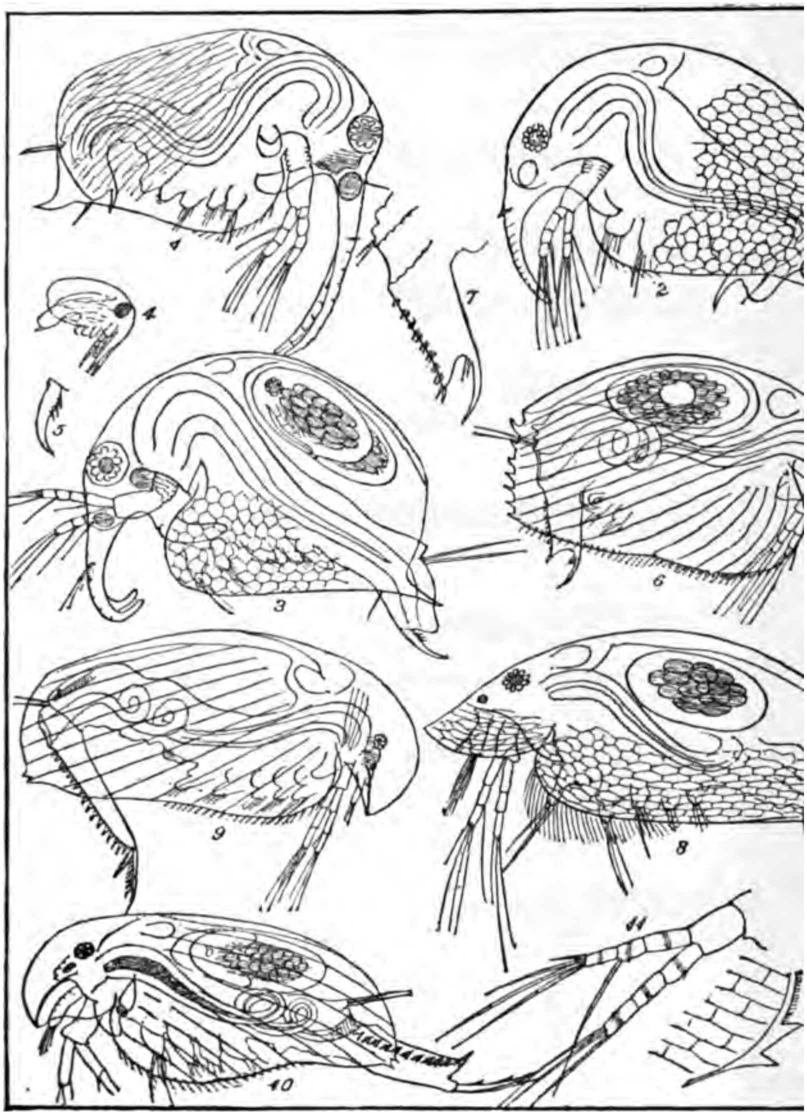

PLATE K.

Fig. 1. *Daphnia minnehaha*, male.
Fig. 2. " " part of feet of first and second pair.
Fig. 3. *Canthocamptus hibernicus*, antenna of female.
Fig. 4. " " fifth foot of female.
Fig. 5. " *palustris*, antenna of male.
Fig. 6. " *trispinosus*, fifth foot of female.
Fig. 7. " *minutus*, young.
Fig. 8. " " nauplius form.
Fig. 9. *Pseudo-sida bidentata*, adult female, antennule, labrum, angle of shell and post-abdomen.
Fig. 10. *Daphnia rosea*, young female.
Fig. 11. " " post-imago.
Fig. 12. " " beak.

MINNESOTA CRUSTACEA.

PLATE K.

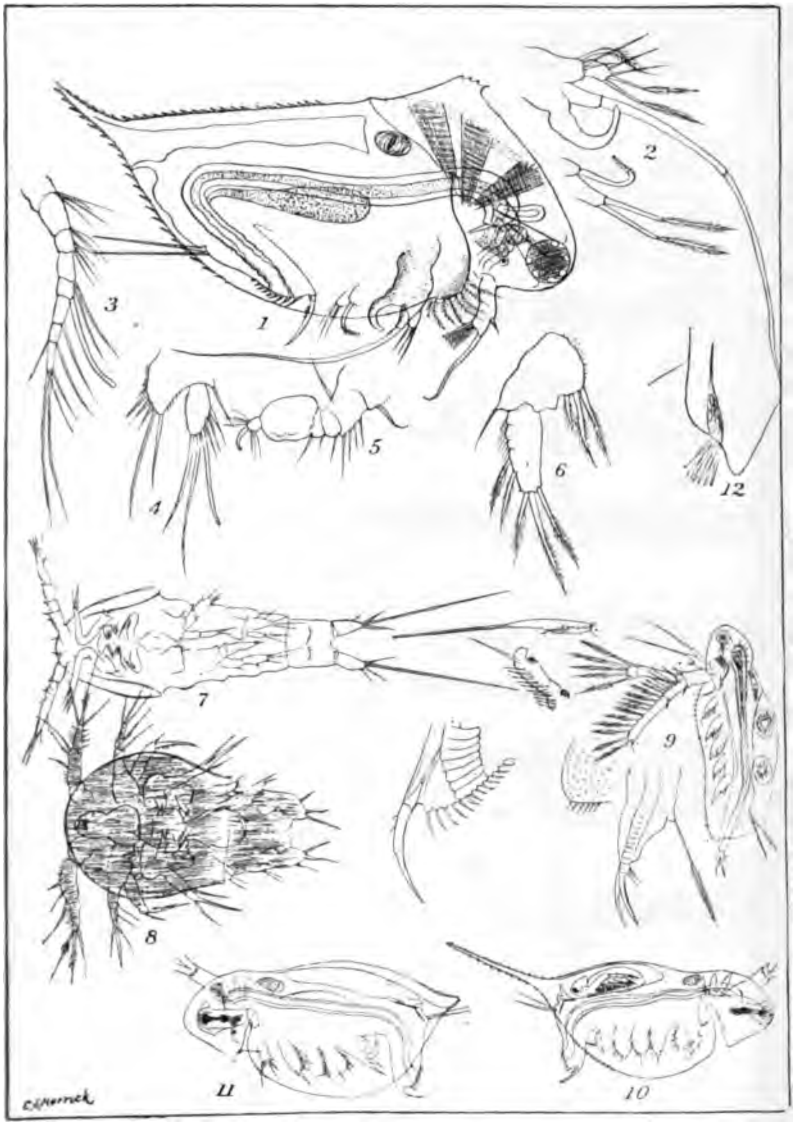

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PLATE L.

Fig. 1. *Daphnia minnehaha*, young female.
Fig. 2. “ “ head of female; 2a. post-abdomen.
Fig. 3. “ *hyalina*, young female.
Fig. 4. “ “ young.
Fig. 5. “ “ post-imago.
Fig. 7. “ *dubia*, young.
Fig. 8. “ “ older female.

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PLATE L.

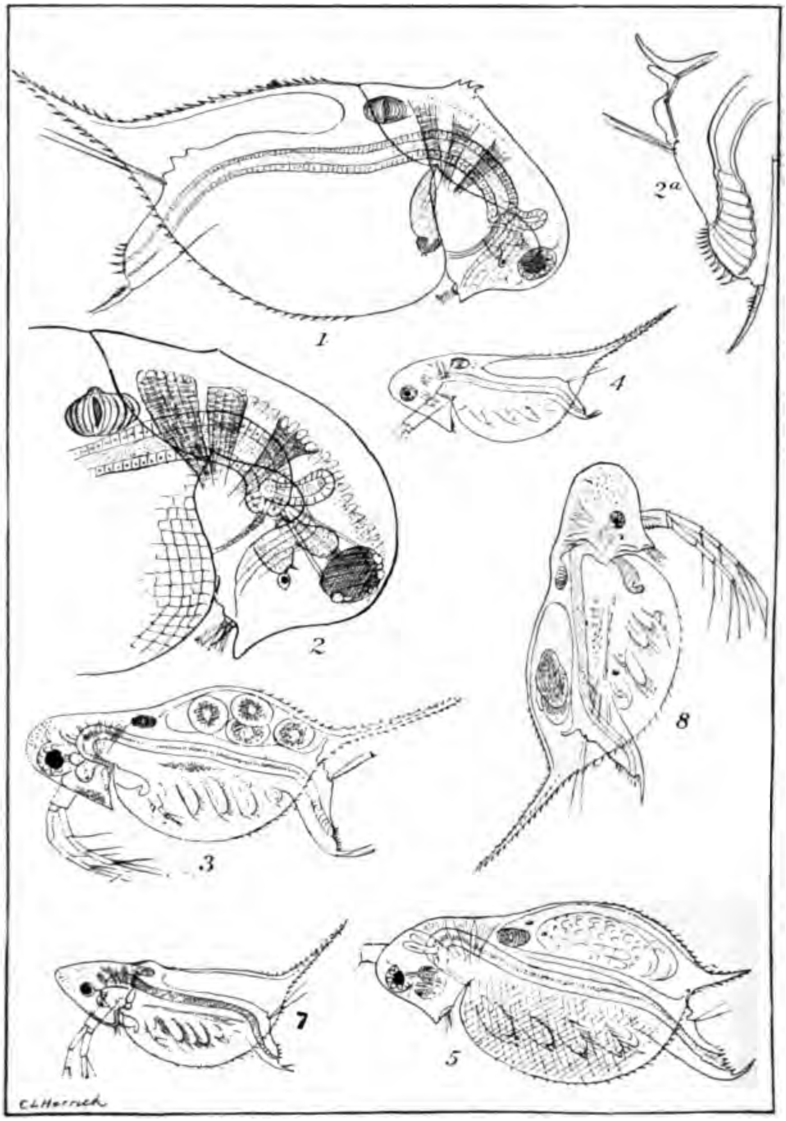

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Fig. 1. *Daphnia schæfferi*, post-abdomen of female.

Fig. 2. " " " " male.

Fig. 3. " " male antennule.

Fig. 4. " " brain and nerves.

inf. œ. g. infra-œsophagal ganglion with nerves to antennæ; œ. œsophagus; n. f. frontal nerve; g. opt. optic ganglion; m. opt. muscles which move the eye; p. f. pigment fleck; n. opt. optic nerve.

Fig. 5. *Daphnia schæfferi*, posterior part of embryo.

Fig. 6. *Eurycercus lamellatus*, heart, showing the anterior bifid portion between the lobes of which is the arterial opening and valve. The vaned arrows represent deeper currents while the unvaned indicate superficial ones. The dotted line represents the position of the pulsating membrane separating the venous from the arterial currents and seen in section at (a).

Fig. 7. *Daphnia similis*, anterior part of the nervous system seen from below. a. optic nerve; b. optic ganglion; c. frontal nerve; d. nerve to antennules; e. commissure connecting upper and lower œsophagal ganglion; f. nerves to antennæ

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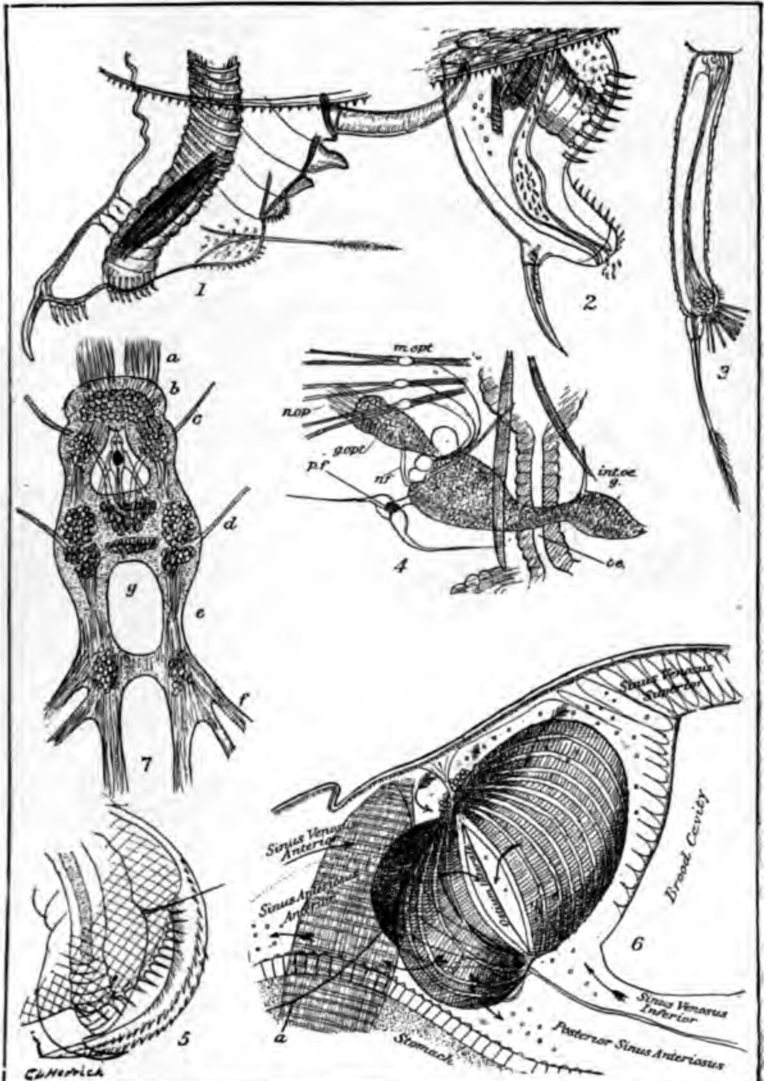

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PLATE N.

Fig. 1-4. *Daphnia pulex, var. nasutus.*
Fig. 5. outline of head and (a) beak of D. similis.
Fig. 6. *Leptodora hyalina*, seen from above.
Fig. 7. " " larva.
Fig. 8. *Latona setifera*, female.
Fig. 9. *Limnosida frontosa*, female.
Fig. 10. " " antennule of male.
Fig. 11. *Holopedium gibberum*, female.
Fig. 12. *Sida elongata*, head outline.
Fig. 13. *Sida crystallina,* head outline of young female.
Fig. 14. " " antennule of male.
Fig. 15. " " " of female.
Fig. 16. *Daphnia galeata*, outline of head.
Fig. 17. " "*vitrea*" " " "

MINNESOTA CRUSTACEA.

12th Annual Report PLATE N. Geol. & Nat. Hist. Sur. Minn.

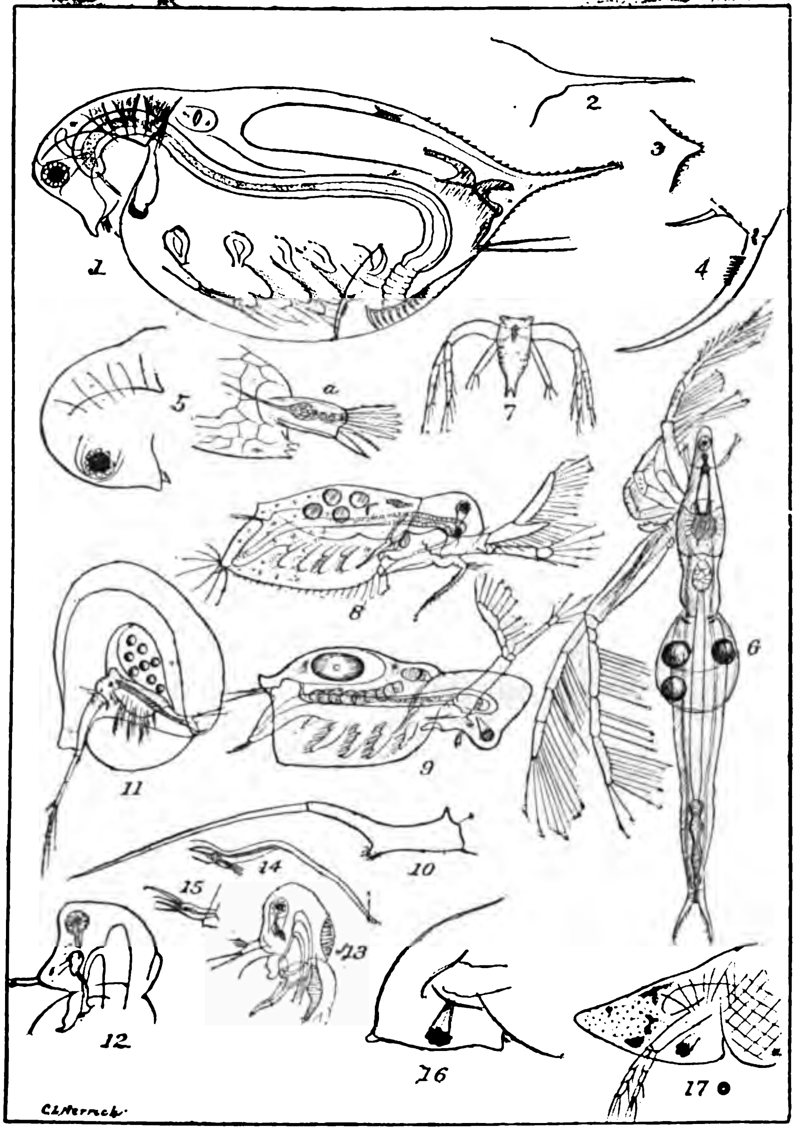

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Fig. 19. outer ramus of first foot.

Fig. 20. *Canthocamptus northumbricus*, inner ramus of third male foot.

Fig. 21. " " beak.

Fig. 22. " " maxilla.

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PLATE O.

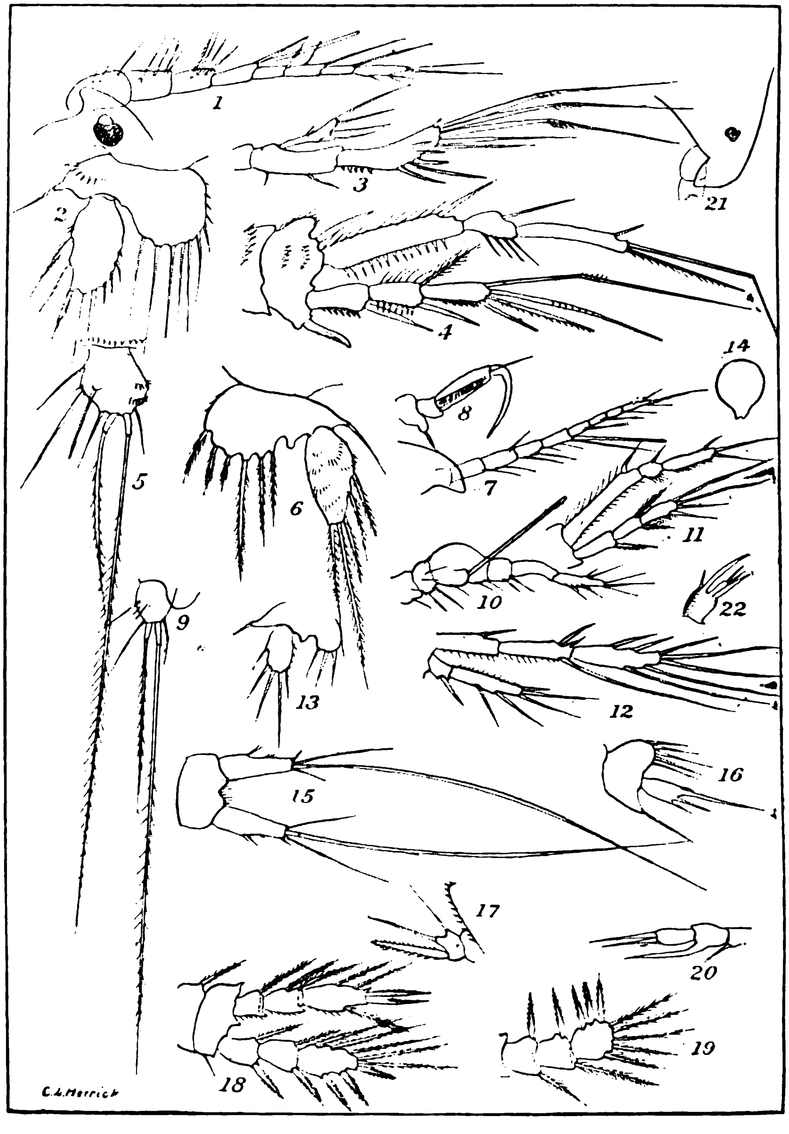

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Fig. 3. A well advanced winter embryo of *D. schœfferi.* a, shell growing over the eyes. b. c, inner shell. d. outer shell. e, lateral part of the head. f, antennules. g, labrum. h, mandibles. i, maxilla. j, second maxilla ? k′, l′, m′, n′, branchial appendages of the 2d–5th pairs of feet. represented by k, l. m, n. o, first foot. p. antenna, q, anus and intestine partly completed. s, shell growing out from the maxillary region.

Fig. 4. Older embryo bursting outer shell.

Fig. 5. Egg after extrusion into the brood cavity.

Fig. 6. Head of young embryo. a, lenses in formation. b, eyes appearing as dark flecks. c, shell growing over the head. d, labrum. e, antennule.

Fig. 7. Longitudinal section through an ephippium.

Fig. 8. Vertical section through an ephippial *Daphnia schœfferi.*

Fig. 9. Somewhat oblique section through the ephippium (a, b, c), heart (h), mandibles (m), and labrum (l).

Fig. 10. A vertical section through the ephippium and its egg.

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12th Annual Report PLATE P. Geol. & Nat. Hist. Sur. Minn.

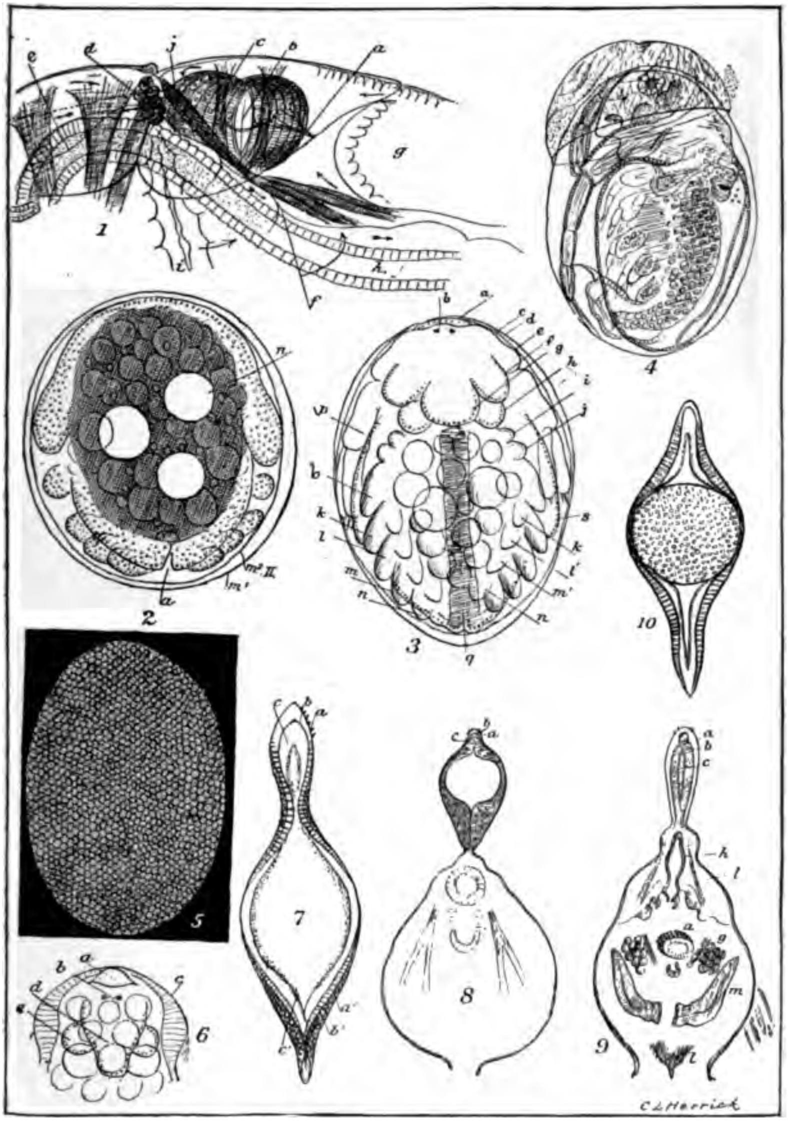

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PLATE Q.

Fig. 1. *Alonella pulchella*, female.
Fig. 2. " " reticulations.
Fig. 3. " " post-abdomen.
Fig. 4. *Alona modesta*, male.
Fig. 5. *Diaptomus similis*, female. 5a. jaw.
Fig. 6. " " fifth foot of male.
Fig. 7. " " " " " female.
Fig. 8. " *minnetonka*, fifth foot of male.
Fig. 9. " " " " " female.
Fig. 10. " " abdomen of female.
Fig. 11. " *stagnalis*, margin of last thoracic segment.
Fig. 12. " *sanguineus*, " " " " "
Fig. 13. " *stagnalis*, fifth foot of the male.
Fig. 14. *Epischura fluviatilis*, abdomen of male.
Fig. 15. " *lacustris*, fifth feet of male.
Fig. 16. " *fluviatilis*, " " " "
Fig. 17. *Diaptomus pallidus* " " " " inner ramus.
Fig. 18. " *sicilis* " " " " " "

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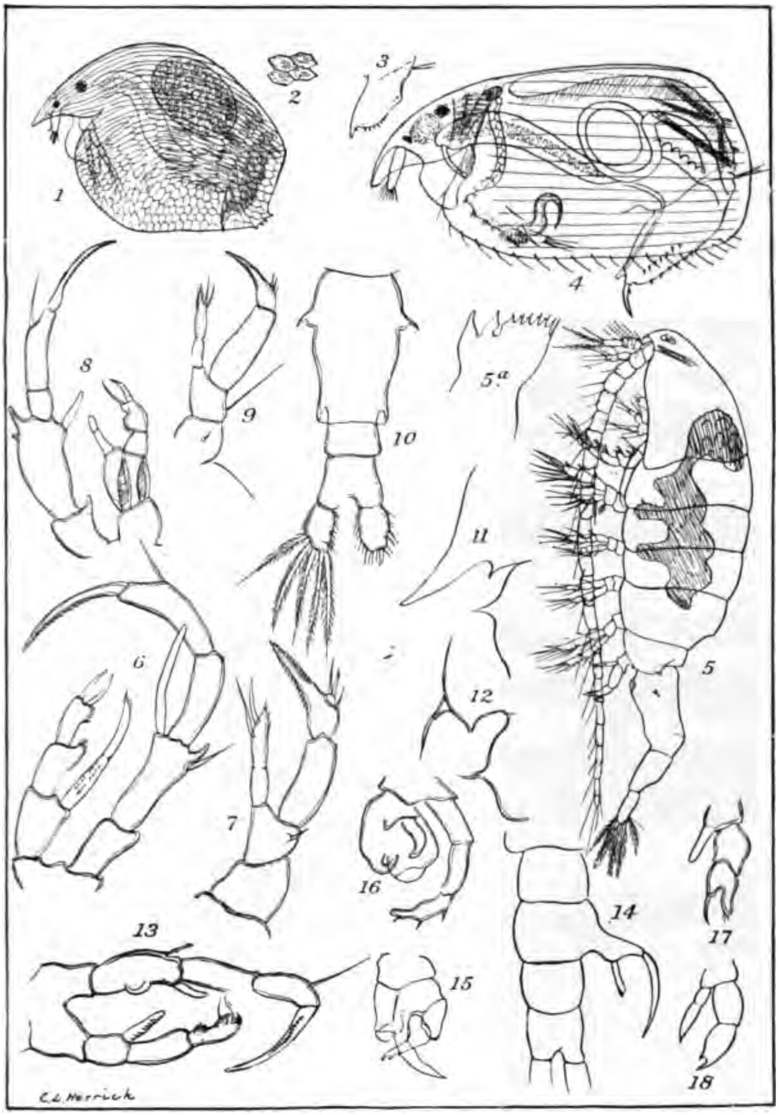

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PLATE Q1.

Fig. 1. *Diaptomus* sp. Young male; external parts as yet but partly developed showing alimentary and reproductive systems as well as a portion of the muscular system. The looped tube is the vas deferens. The small irregularly coiled tube anteriorly is the shell-gland or kidney.

Fig. 2. female with ovary, oviducts and heart.

Figs. 3-4. Nauplius larva of same.

Figs. 5-6. fifth pair of feet of male and female.

Fig. 7. mouth appendages, anteriorly the base of antennæ followed by antennule, labrum, maudible with palp, maxilla and maxilliped.

MINNESOTA CRUSTACEA.

m *the 10th Annual Report.* PLATE Q1. *Geol. & Nat. Hist. Sur. Minn.*

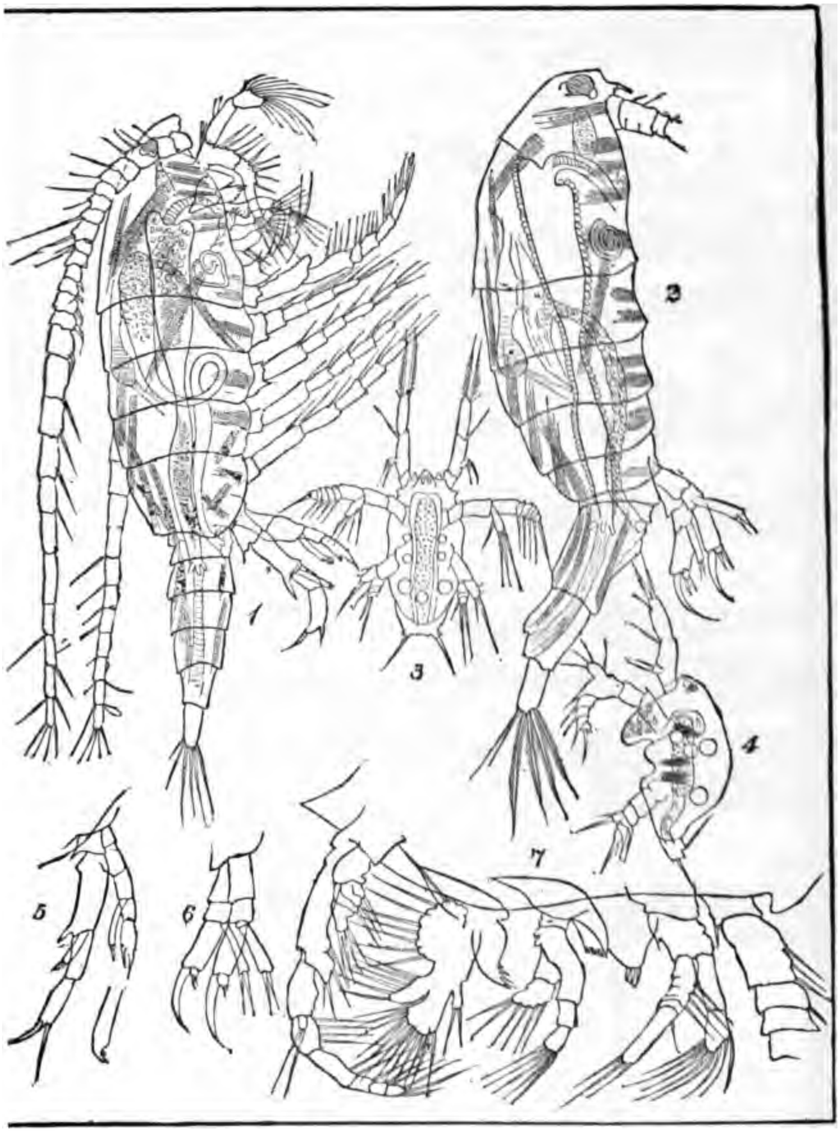

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PLATE Q^{2}.

Fig. 1. *Osphranticum labronectum* (*Potamoichetor*), male.
Fig. 2. antennule.
Fig. 3. maxilliped.
Fig. 4. fifth feet of male.
Fig. 5. palp of mandible.
Fig. 6. end of abdomen.
Fig. 7. feet of first pair.
Fig. 8. eye.
Fig. 13. maxilla.
Fig. 14. mandible.
Fig. 9. *Cyclops ater*, female.
Fig. 10. abdomen.
Fig. 11. maxilliped.
Fig. 12. antenna.

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From the 10th Annual Report. PLATE Q2. *Geol. & Nat. Hist. Sur. Mi*

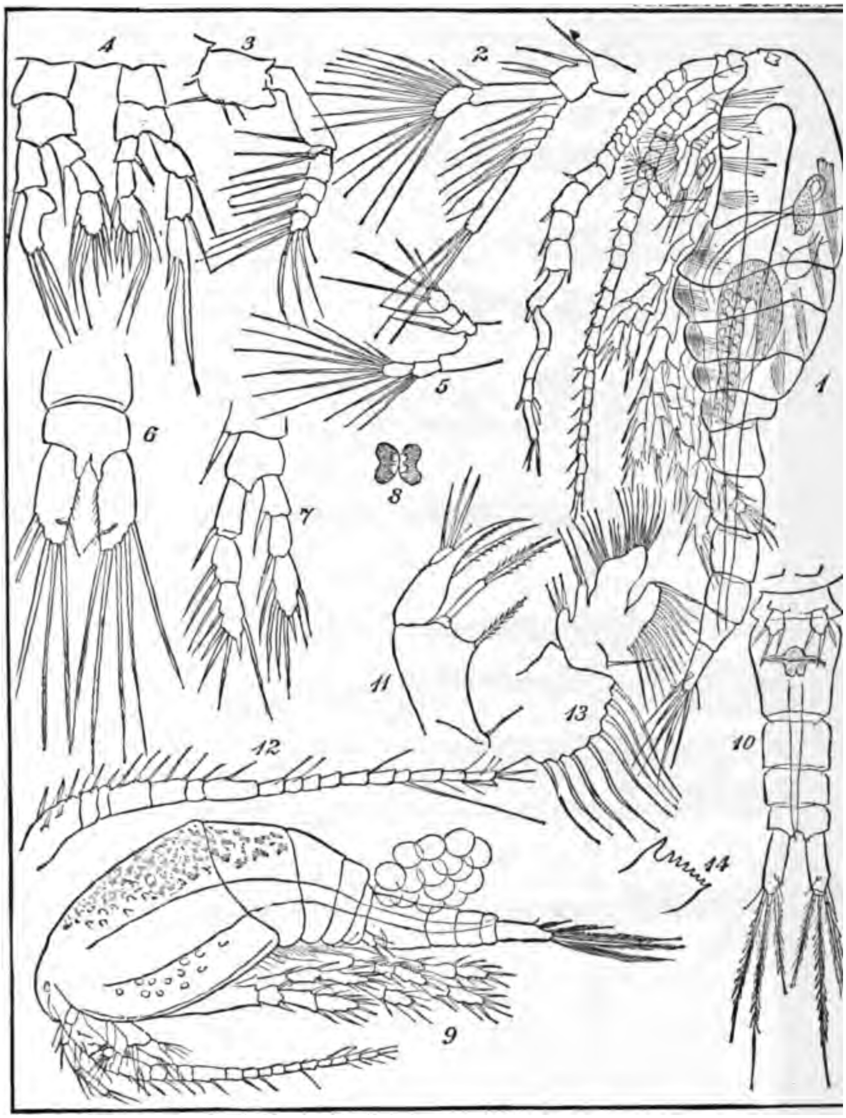

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Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11.
Fig. 12.
Fig. 13.
Fig. 14.

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From the 10th Annual Report. PLATE Q^{3}. *Geol. & Nat. Hist. Sur. Mi*

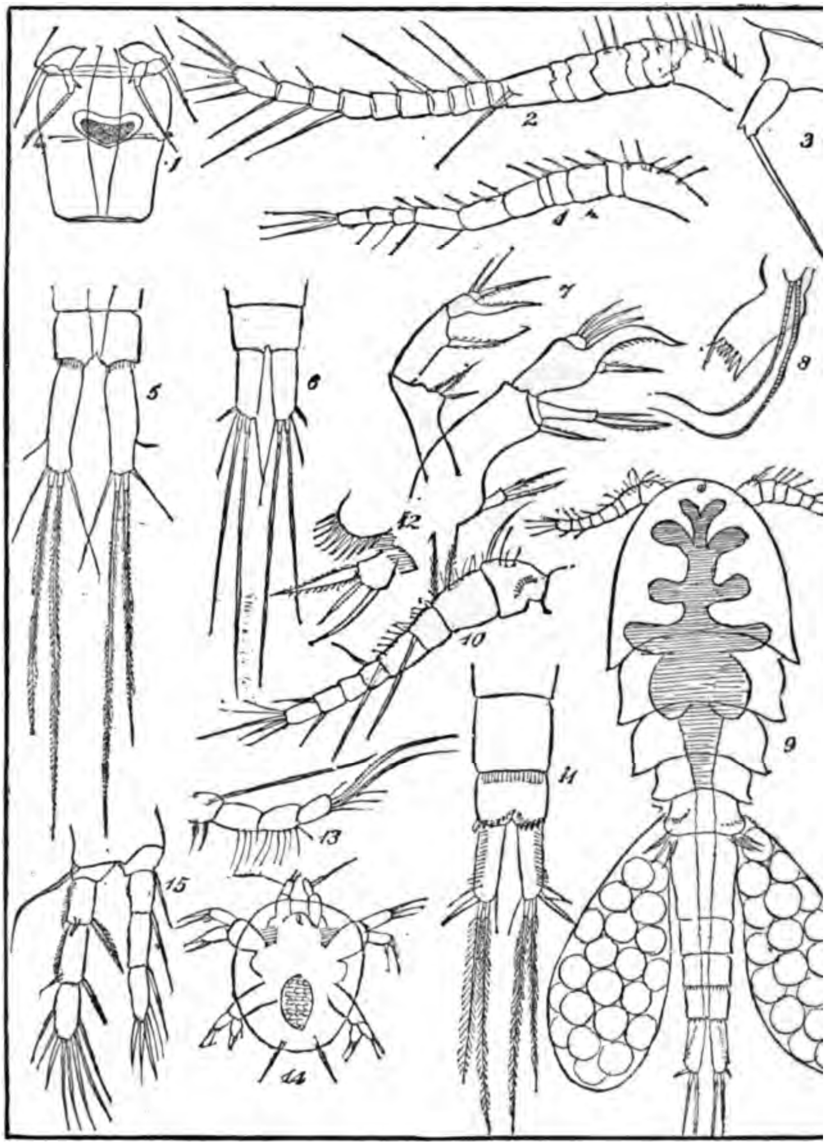

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Fig. 1. *Cyclops tenuicornis*, female.
Fig. 2. mandible.
Fig. 3. maxillæ.
Fig. 4. stylet.
Fig. 5. fifth foot.
Fig. 6. maxillipedes.
Fig. 7. antennæ.
Fig. 8. *Cyclops* "*signatus*," abdomen.
Fig. 9. antenna.
Fig. 10. fifth foot.
Fig 11. male antenna.
Fig. 12. *Cyclops parcus*, abdomen.
Fig. 13. antenna.
Fig. 14. fifth foot.
Fig. 15. *Cyclops* "*adolescens*," opening of spermatheca and cement gland.
Fig. 16. *Cyclops* "*adolescens*," abdomen.
Fig. 17. foot.
Fig. 18. antenna of female.
Fig. 19. eye.
Fig. 20. antenna of male.
Fig. 21. *Cyclops* "*signatus*," end of antenna.

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From the 10th Annual Report. PLATE Q^4. *Geol. & Nat. Hist. Sur. Min*

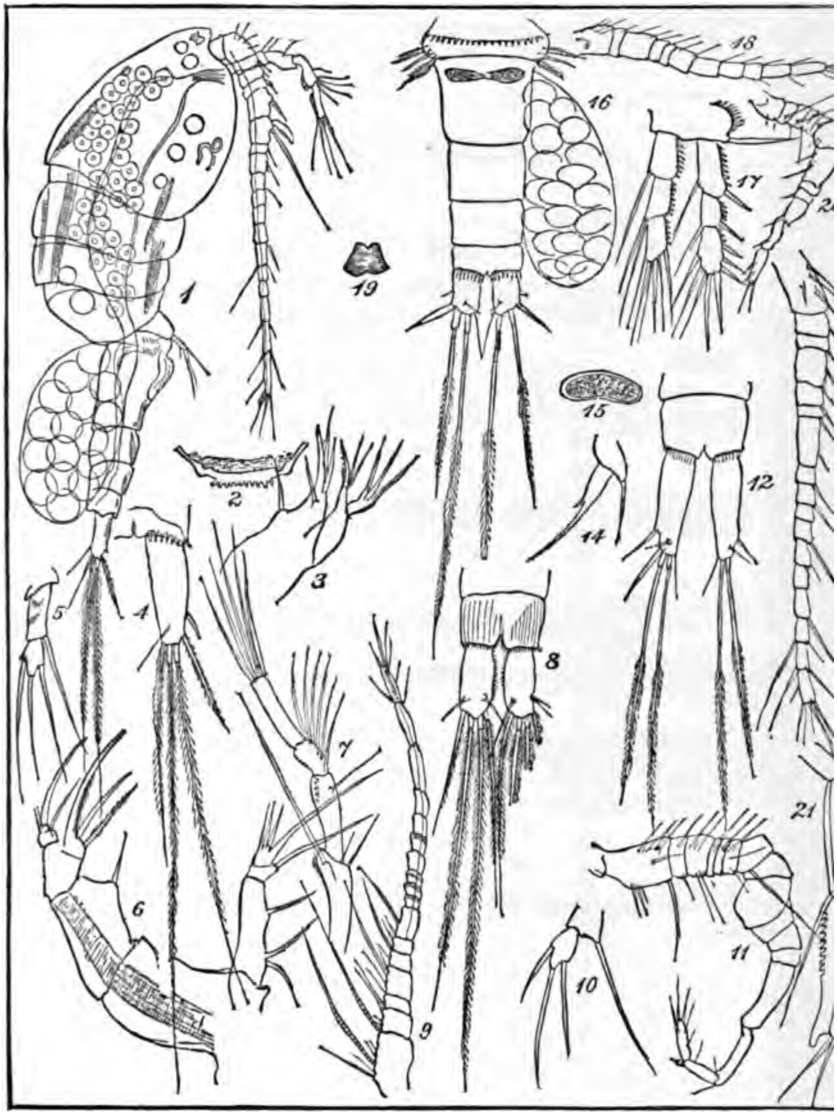

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PLATE Q 5.

Fig. 1. *Cyclops fluviatilis*, female.
Fig. 2. antenna.
Fig. 3. antenna of young.
Fig. 4. abdomen of young.
Fig. 5. foot of young.
Fig. 6. foot of adult.
Fig. 7. fifth foot.
Fig. 8. eye.
Fig. 10. *C. serrulatus*, young.
Fig. 11. *Daphnella brachyura*, female.
Fig. 12. *Daphnella brachyura*, male.
Fig. 13. edge of valves.
Fig. 14. abdomen of male.
Fig. 15. abdomen of female.
Fig. 16. antenna of male.

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From the 10th Annual Report. PLATE Q5. *Geol. & Nat. Hist. Sur. Mini*

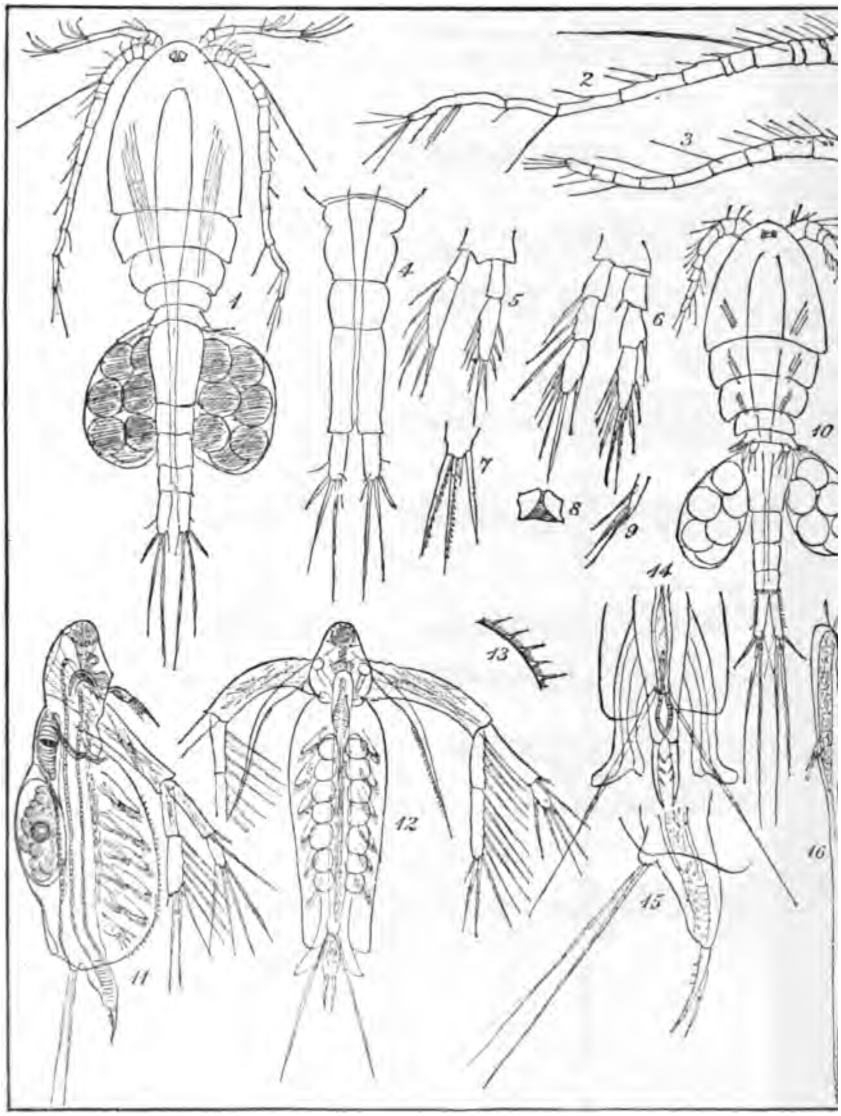

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PLATE R.

Fig. 1. *Cyclops modestus.*
Fig. 2. " " end of abdomen.
Fig. 3. " " outer ramus of first foot.
Fig. 4. " " " " " second foot.
Fig. 5. " " fifth foot.
Fig. 6. " *phaleratus*, fourth foot.
Fig. 7. " " outer ramus of first foot.
Fig. 8. " " fifth foot.
Fig. 9. " " caudal stylets.
Fig. 10. " " antenna of young otherwise perfect.
Fig. 11. " *fimbriatus*, end of abdomen.
Fig. 12. " *diaphanus*, abdomen.
Fig. 13. " *ater*, inner ramus of first foot.
Fig. 14. " " outer " " " "
Fig. 15. " " " " " fourth foot.
Fig. 16. " "*signatus*," fourth foot.
Fig. 17. " *ater*, inner ramus of fourth foot.
Fig. 18. " " stylet.
Fig. 19. " *sp.?* first foot.
Figs. 20, 21. " " terminal segments of fourth foot.
Fig. 22. " " fifth foot.
Fig. 23. *Chydorus globosus*, first foot of male.

MINNESOTA CRUSTACEA.

PLATE R.

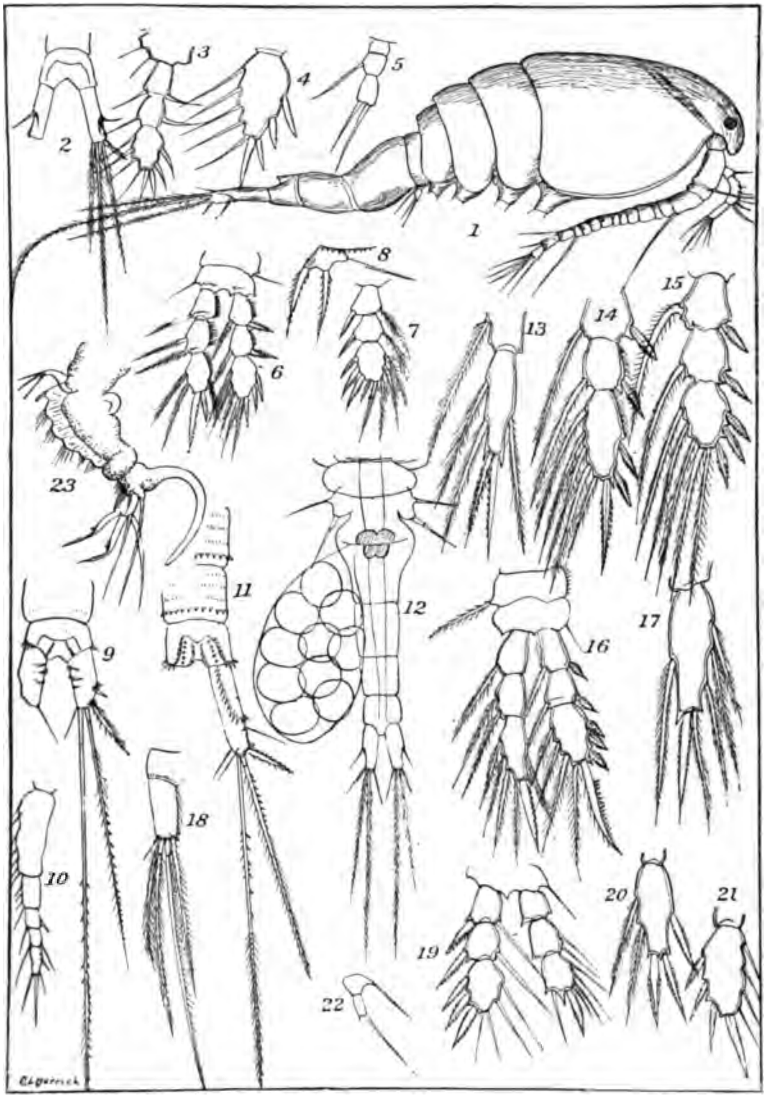

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Fig. 11. antennule.
Fig. 12. " " " opening of spermatheca
Fig. 13. *Cyclops sp.?*, nauplius.

MINNESOTA CRUSTACEA.

PLATE S.

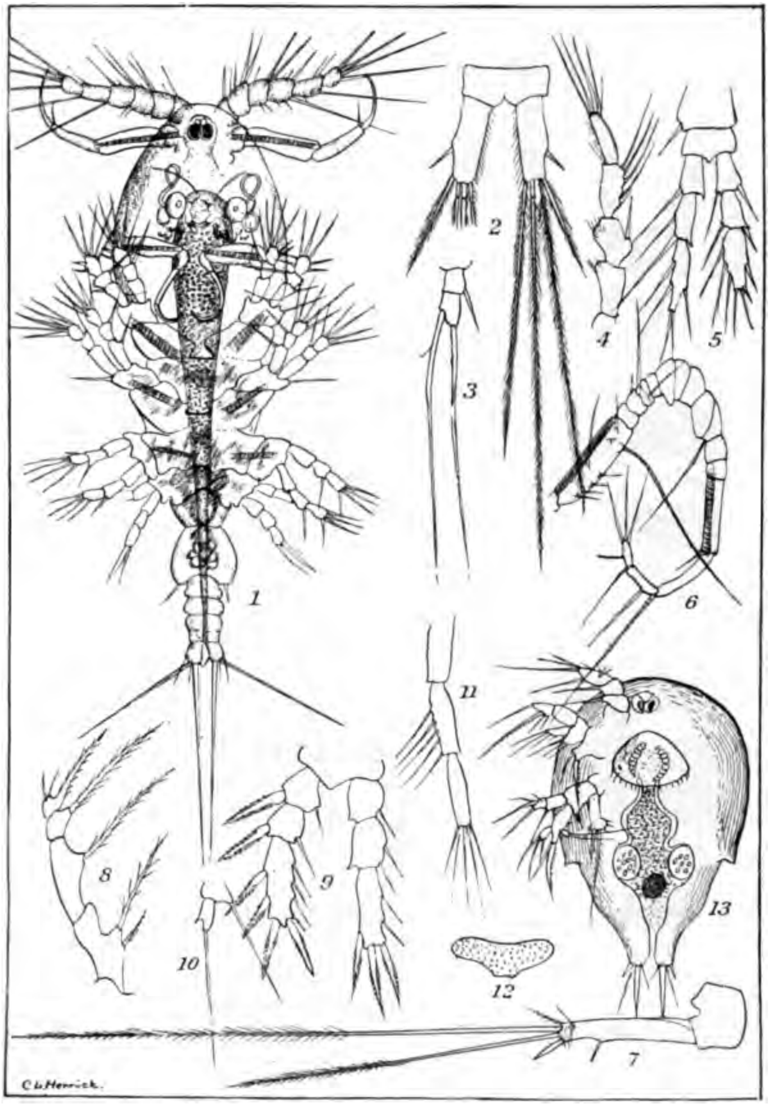

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Fig. 1. *Canthocamptus minnesotensis*, first foot.
Fig. 2. " " stylets.
Fig. 3. " " antenna of female.
Fig. 4. " " fifth foot of female.
Fig. 5. " " " " " male.
Fig. 6. " " antenna of male.
Fig. 7. *Daphnia galeata*, young.
Fig. 8. " " male.
Fig. 9. *Camptocercus leucocephalus*, male.
Fig. 10. *Alonella excisa*, male.
Fig. 11. *Cyclops insignis*, first foot, outer ramus.
Fig. 12. " " fifth foot.
Fig. 13. " " fourth foot.
Fig. 14. " " stylet.
Fig. 15. Worm parasitic in arterial sinus of *Daphnia schæfferi*.

MINNESOTA CRUSTACEA.

12th Annual Report — PLATE T. — Geol. & Nat. Hist. Sur. Minn.

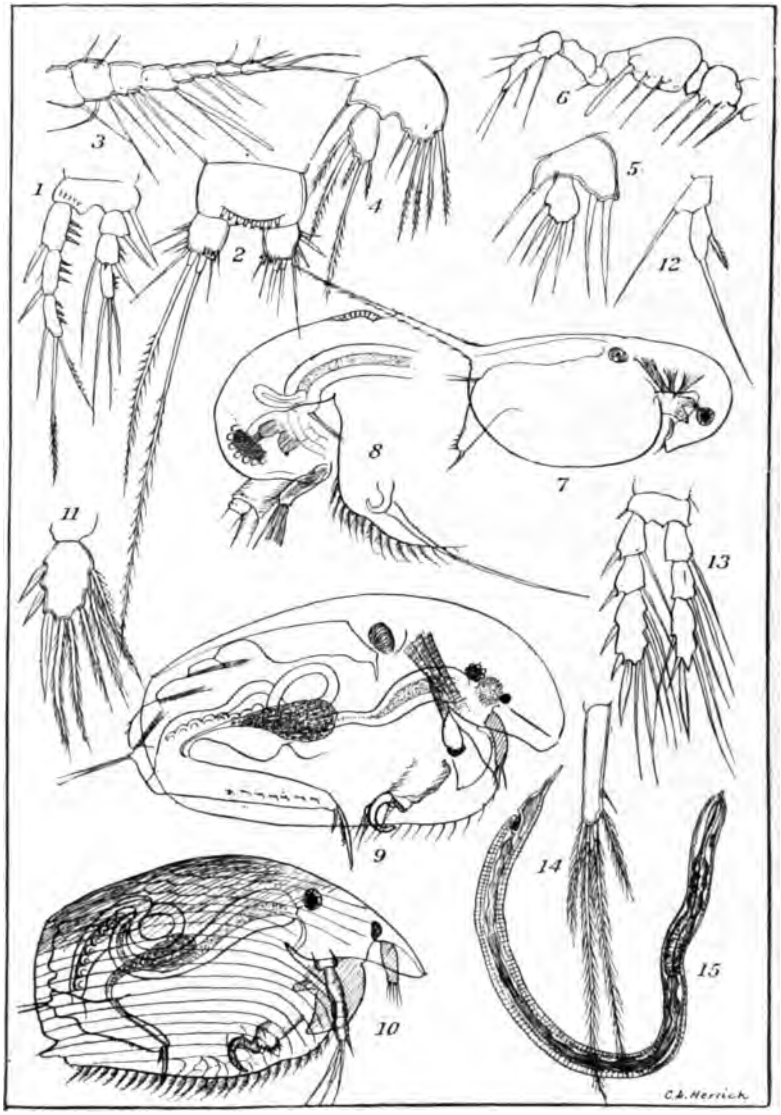

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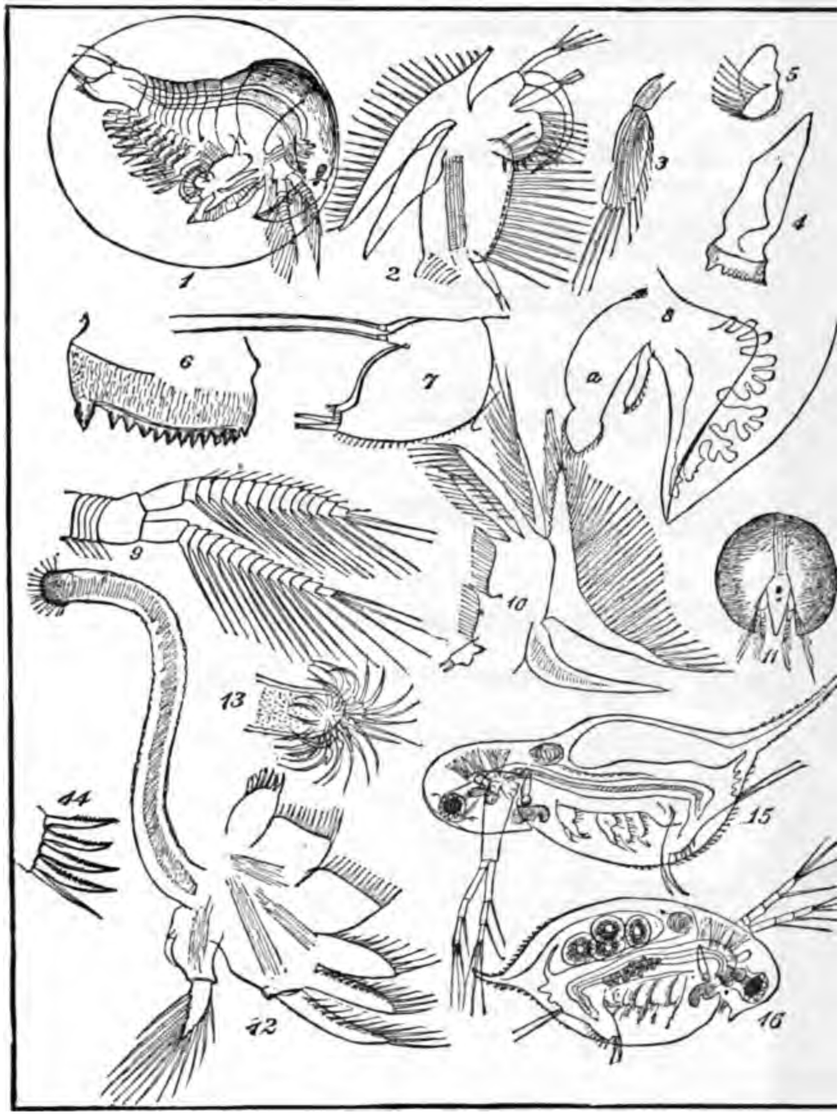
PLATE C.

Figs. 1-14 *[illegible] pallida Baird.*
Fig. 15 *Syngnathus [illegible] Girard.*
Fig. 16 *Syngnathus arundinaceus Girard.*

MINNESOTA CRUSTACEA.

From the 10th Annual Report. PLATE U^1. *Geol. & Nat. Hist. Sur. Min*



Figs. 5, 6, 7. Rotifera found with entomostraca in Minnesota.

Fig. 8. Flask-shaped rotifer, hermaphrodite, with eggs and sperm. a. jaws and head; b. shell gland; c. glandular portion of the stomach; d. testes; e. œsophagus; f. one of several embryos.

Fig. 9. jaws of the above.

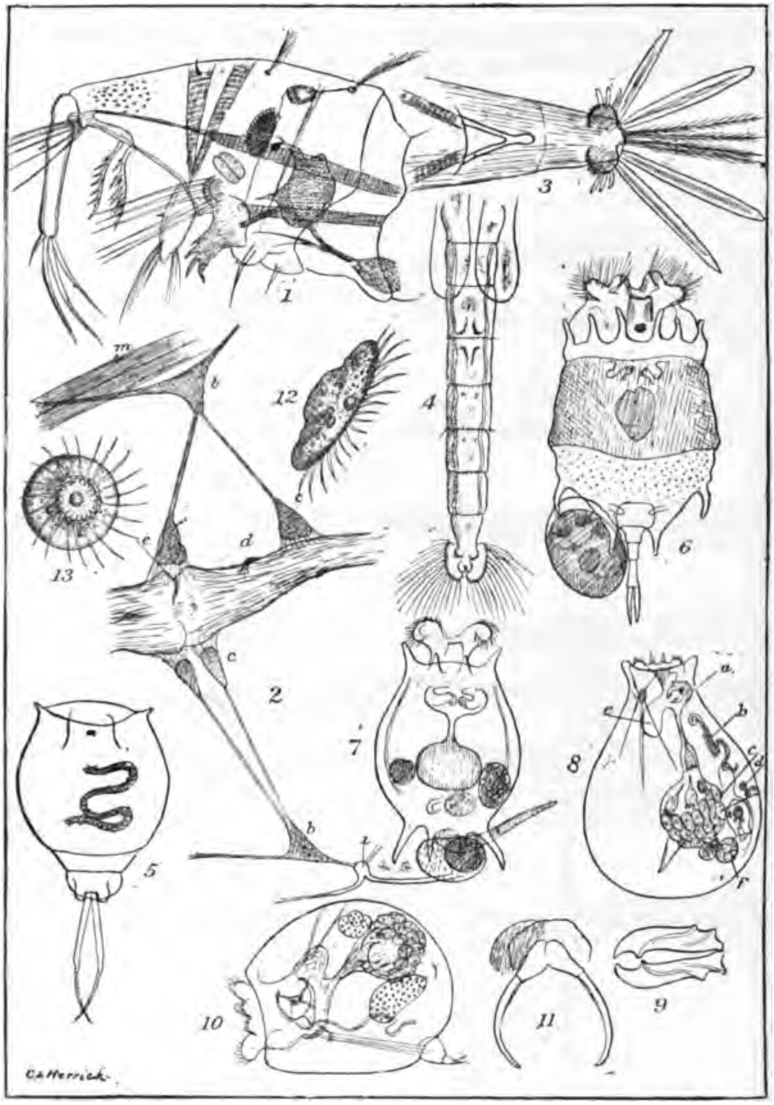
Fig. 10. similar animal, female, deadly enemy to Chydorus.

Fig. 11. jaws of same.

Figs. 12, 13. ? pedicularis, ecto-parasite of *Diaptomus.*

MINNESOTA CRUSTACEA.

12th Annual Report **PLATE V.** Geol. & Nat. Hist. Sur. Minn.



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VI.

BOTANY.

Y Warren Upham.

THE GEOLOGICAL AND NATURAL HISTORY SURVEY OF MINNESOTA.

N. H. WINCHELL, STATE GEOLOGIST.

CATALOGUE

OF THE

FLORA OF MINNESOTA,

INCLUDING ITS

PHÆNOGAMOUS AND VASCULAR CRYPTOGAMOUS PLANTS,

INDIGENOUS, NATURALIZED, AND ADVENTIVE.

By WARREN UPHAM.

Part VI of the Annual Report of Progress for the Year 18

MINNEAPOLIS:
JOHNSON, SMITH & HARRISON.
1884

THE FLORA OF MINNESOTA.

The following catalogue of the plants of Minnesota is presented as a report of progress in this department of the geological and natural history survey of the state. It includes not only the observations of the state geologist and his assistants upon this survey, but also those of earlier botanic collectors and explorers, enumerating all the species that are known to have been found in Minnesota by all observers up to the present time. Grateful mention of the various sources, in chronologic order, from which this list is largely a compilation, is therefore its most appropriate preface.

Hennepin, Carver, Pike, and other early explorers of this state, occasionally refer to some of its forest trees, wild fruits and berries, and plants used for food or medicine by the Indians. Carver, who traveled to the upper part of the Minnesota river in 1767, wrote of the region through which it flows:—"Wild rice grows here in great abundance; and every part is filled with trees bending under their loads of fruits, such as plums, grapes, and apples; the meadows are covered with hops, and many sorts of vegetables; whilst the ground is stored with useful roots, with angelica, spikenard, and groundnuts." On the uplands bordering the river he saw "such amazing quantities of maples, that they would produce sugar sufficient for any number of inhabitants."

The first published list of plants, so far as known to the writer, that includes species found in Minnesota, is in the *American Journal of Science*, vol. iv, 1822, pages 56 to 69, entitled "Notice of the Plants collected by Professor D. B. Douglass, of West Point, in the expedition under Governour Cass, during the summer of 1820, around the Great Lakes and the upper waters of the Mississippi: the arrangement and description, with illustrative remarks, being furnished by Dr. John Torrey." This includes 115 species, 26 of which were from Minnesota.

The appendix of Keating's *Narrative of Major Long's Expedition* in the year 1823, along the Minnesota river and the Red river of the North to lake Winnipeg, and thence by the lake of the Woods and Rainy lake to lake Superior, contains in pages 105 to 123, "a Catalogue of Plants collected in the North-western Territory by Mr. Thomas Say", who accompanied this expedition. These plants were determined and the catalogue prepared for publication by Lewis D. de Schweinitz, excepting the first five species which were by Nuttall. The flowering plants and ferns in this list include 124 species, 30 of which are referred definitely to Minnesota. Both the foregoing lists are arranged according to the Linnæan system.

In Schoolcraft's *Narrative of an Expedition through the upper Mississippi to Itasca lake, in 1832*, pages 160 to 165 are entitled "Localities of Plants collected in the Northwestern Expeditions of 1831 and 1832; by Douglass Houghton, M. D., Surgeon to the Expeditions." The genera in this list are arranged alphabetically, and include 247 species, 115 of which are referred to this state.

Nicollet's report, describing the basin of the upper Mississippi river, from explorations during the years 1836 to 1839, contains in pages 143 to 165, a "Catalogue of plants collected by Mr. Charles Geyer, under the direction of Mr. J. N. Nicollet, during his exploration of the region between the Mississippi and Missouri rivers: by Professor John Torrey, M. D." Of the 446 species in this catalogue, about 60 were collected in Minnesota, most of the others being from Dakota.

Owen's geological report presents in its appendix, in pages 606 to 622, a "Systematic Catalogue of Plants of Wisconsin and Minnesota, by C. C. Parry, M. D., made in connexion with the Geological Survey of the Northwest, during the season of 1848." The author states that "the number of plants comprised in this list is seven hundred and twenty-seven, included in one hundred and six natural orders." Many of them are particularly mentioned as occurring in this state, and often interesting descriptive notes are added, some of which are quoted in the following pages.

The next contribution to our knowledge of the flora of the state is by Mr. Thomas Clark, on the "Botany of the Northeastern Geological District of Minnesota", forming pages 73 to 82 of the report of the state geologist, Aug. H. Hanchett, M. D., in 1865. About a hundred species are here enumerated. Some thirty of them, however, only occur in cultivation, being mostly the common grains and garden vegetables, noted to show the agricultural capability of the region. The other species of this list include chiefly the most important forest trees, and such shrubby and herbaceous plants as seemed of special interest because of their fruit or medicinal qualities, accompanied with remarks respecting the size of the trees, and the abundance and geographical limits of the native species.

The most valuable of all the publications concerning the botany of Minnesota, and the only attempt, before the present, to give a complete list, so far as known, of our flora, was "a Catalogue of the Plants of Minnesota, by I. A. Lapham, LL. D., of Milwaukee, Wis.", which he prepared in 1865. Eight years later, soon after the initiation of the present survey of the state, he generously sent this manuscript to professor Winchell, as state geologist. It was published in the report of the State Horticultural Society for 1875. In the preface, Dr. Lapham states that he had consulted the lists of plants already enumerated from Douglass to Parry; but that his catalogue, nevertheless, rests chiefly upon his "own observations and collections made during several excursions into the State; one of which, in the spring of 1857, was extended to the waters of the Red River of the North." Dr. Lapham refers to his additional sources of information, as follows:—"In 1858 Mr. Robert Kennicott made collections of plants and animals in the Red River country which are preserved by the Northwestern University at Evanston, Illinois. Mr. Charles A. Hubbard collected expressly for me a large number of plants, including mosses and lichens, while on a tour from Lake Superior to Lake Winnipeg and Pembina, as well as while on his return by way of St. Paul. In 1861 Mr. T. J. Hale, while prosecuting geological investigations along the Mississippi river in connection with the Wisconsin State survey, made some collections of plants in Minnesota, a list of which he has kindly furnished to me. Several species are introduced upon his authority." The flowering plants and vascular cryptogams in this catalogue comprise 896 species, besides which it also enumerates 55 species of mosses, liverworts and lichens found in Minnesota. It is without notes, in respect to the part of the state where plants of limited range occur, and does not indicate whether the species are common or rare.

Mr. George M. Dawson's report to the British North American Boundary Commission, on the *Geology and Resources of the region in the vicinity of the Forty-ninth Parallel, from the Lake of the Woods to the Rocky Mountains*, published in 1875, contains in pages 351 to 379, a list of plants collected in this survey during the summers of 1873 and 1874, with notes of their localities and dates of collection, stating whether they were found in flower or in other stages of growth. This enumerates 636 phænogams and vascular cryptogams, of which 289 were collected on the northern border of Minnesota, from the lake of the Woods to the Red river. Twenty-three species of mosses and lichens were also collected on this part of the international boundary. The rushes, sedges and grasses of this list were determined by Prof. John Macoun; by whom, as also by Mr. Dawson, some additional notes respecting their identifications of species and more recent collections in the same region and thence eastward to lake Superior, have been kindly furnished.

Another collection of plants, numbering about 300 species, was made on the same survey, along its extent from the Red river to the Rocky mountains, in connection with the U. S. Northern Boundary Commission, by Dr. Elliott Coues, who submitted them to Prof. J. W. Chickering for determination and report. With these were also incorporated the species of Mr. Dawson's list (excepting mosses and lichens), so far as they were not included in Dr. Coues' collection, making a catalogue of 692 species, besides several varieties; which was published in 1878 in the *Bulletin of the United States Geological Survey*, vol. iv, pages 801 to 830. Ninety-six species are stated to have been found at Pembina, situated on the Red river, adjoining Minnesota.

A few species of Carex, collected by Sir John Richardson at Rainy lake and the lake of the Woods, and determined by Dr. Francis Boott, are included in the botanical appendix of Richardson's *Arctic Expedition in Search of Sir John Franklin*; which also gives much valuable information as to the geographic limits northward of many of our plants.

A list of the ferns of Minnesota, collected by Miss E. W. Cathcart, comprising thirty species and three varieties, was published in 1877 in the *Bulletins of the Minnesota Academy of Natural Sciences*, vol. i, pages 303 and 304. This list includes two especially interesting species, the very rare Phegopteris calcarea, Fée, and Woodsia scopulina, Eaton, which here reaches its eastern limit.

The Report of the Minnesota Horticultural Society for 1884 contains, in pages 83 to 116, a valuable paper by Miss Sara Manning, on "The Wild Flowers of the Lake Pepin Valley", including a catalogue of 504 species.

In the same report, on pages 361 to 367, are "Notes on the Flora of western Dakota and eastern Montana adjacent to the Northern Pacific railroad," by John B. Leiberg, in which are frequent inci- references to Minnesota.

present *Geological and Natural Hist-*

ory Survey of Minnesota, notices of the botany of portions of the state have been published as follows:—

In the first annual report, for the year 1872, a "List of Plants, mostly herbaceous, in the neighborhood of St. Anthony, Minnesota; principally found on the University Grounds. 1869—1872. By Professor E. H. Twining." This includes 230 species.

In the report for 1873, lists of the trees and shrubs of the Big Woods, and of Big Stone lake, by Prof. Winchell.

In the report for 1874, lists of the trees and shrubs of Freeborn and Mower counties, by Prof. Winchell.

In the report for 1875, the trees and shrubs of Fillmore county, by Prof. Winchell; and of Olmsted, Dodge and Steele counties, by Prof. M. W. Harrington.

In the report for 1876, the trees and shrubs of Houston and Hennepin counties, by Prof. Winchell.

In the report for 1877, the trees and shrubs of Ramsey county, by Prof. Winchell; and of Rice county, by Prof. L. B. Sperry.

In the report for 1878, pages 35 to 46, "The Plants of the North Shore of Lake Superior. By B. Juni." This is a list, with numerous notes of localities and relative abundance, and occasional descriptive remarks, of 218 species collected by Mr. Juni, in the summer of that year, in connection with the party there engaged in geological exploration; with 58 additional species, collected in the vicinity of the University, at Minneapolis, including 25 species of Carex, while 23 others of this genus are in the list preceding.

In the report for 1879, pages 138 to 149, another list of "Plants of the North Shore of Lake Superior, collected by T. S. Roberts", in connection with the geological survey in that year, from July 26 to Sept. 2; including 220 species, with frequent notes of locality, relative abundance, and other description; 100 of these species being in addition to Mr. Juni's list.

And, in the report for 1880, pages 201 to 216, lists of 76 species of forest trees, 31 shrubs, and 259 herbaceous plants, identified by Mr. O. E. Garrison in the region of the head-waters of the Crow Wing river, the White Earth reservation, Itasca lake, and the upper Mississippi, during an exploration in the summer of that year for the Forestry Department of the United States Census.

Besides these publications, very important contributions of notes and specimens have been received from botanists throughout the state. Mr. John B. Leiberg, of Mankato, supplied a list of about 750 species, collected in 1882, mostly in Blue Earth county, but including also a considerable number from the southwest part of the state. Many specimens collected in Blue Earth county, and others from Dakota and Montana, have been donated by Mr. Leiberg to the State Museum. A list of about 500 species, observed chiefly in the vicinity of Minneapolis by the Young Naturalists' Club, was communicated by Mr. Thomas S. Roberts, by whom nearly all these species were determined, others being by Clarence L. Herrick, F. S. Griswold, and R. S. Williams. I am also indebted to Mr. Roberts for much further assistance in the preparation of the following catalogue. Manuscript lists, to which references are frequently made in stating the geographic range of species or localities of rare or local plants, were received from Mr. George B. Aiton, of Owatonna; Miss Franc E. Babbitt, of Little Falls; Miss F. S. Beane, of Faribault; Mrs. C. H. Bennett, of Pipestone City; Mrs. A. C. Blaisdell, of Saint Cloud; Mr. and Mrs. C. W. Blake, of Cannon River Falls; Miss Eloise Butler, of Minneapolis; Rev. E. V. Campbell, of Saint Cloud; Mrs. M. C. Carter, of Hesper, Iowa; Miss E. W. Cathcart, of Washington, D. C.; Prof. L. W. Chaney, Jr., of Northfield; Mr. R. I. Cratty, of Armstrong's Grove, Iowa; Miss Phebe A. Field, of Stillwater; Mr. Lewis Foote, of Worthington; Mr. O. E. Garrison, of Saint Cloud; Prof. C. J. Gedge, of Moorhead; Mr. H. F. Gibson, of Wabasha; Mr. W. H. Hatch, of Rock Island, Illinois; Dr. V. Havard, surgeon at Fort Pembina, Dakota; Mr. C. L. Herrick, of Minneapolis; Prof. John M. Holzinger, of Winona; Mr. B. Juni, of New Ulm; Mr. J. C. Kassube, of Minneapolis; Dr. and Mrs. H. C. Leonard, of Fergus Falls; Miss Sara Manning, of Lake City; Rev. John Pemberton, of Saint Paul; Mrs. J. W. Ray, of Lake City; Dr. J. H. Sandberg, of Red Wing; Rev. John Scott, of Emerson, Manitoba; Rev. H. M. Simmons, of Minneapolis; Mrs. E. H. Terry, of Saint Paul; and Prof. N. H. Winchell, of Minneapolis. Many observations in respect to the relative abundance and geographic range of species have been also noted by the writer during explorations for this survey.

Though not within the province of this catalogue, it seems desirable to mention here the lists of 775 species of Fungi, by Dr. A. E. Johnson, of Minneapolis, in the *Bulletins of the Minnesota Academy of Natural Sciences*, vol. i. These were nearly all collected by Dr. Johnson within the limits of Hennepin, Ramsey, Wright and Anoka counties. The fifth annual report of this survey, for the year 1876, contains the same, but with the notes somewhat abbreviated, to the number of 558 species, the extent to which the work had been carried at the date of that report. Dr. Johnson has also given much attention to the study of the fresh-water algæ, determining a large number of species.

Another successful student of fresh-water algæ, especially of the Desmids, is Miss Eloise Butler, of Minneapolis. An article respecting these microscopic plants, by Mr. Francis Wolle, in the *Bulletin of the Torrey Botanical Club* for February, 1883 (vol. x, pages 13 to 21), enumerates eighteen species new to the United States, collected by Miss Butler in the vicinity of Minneapolis, including eight forms (three species and five varieties) new to science.

CONDITIONS DETERMINING THE CHARACTER OF THE FLORA.

In considering the botany of any district, its geographic position, elevation and contour, the climate, and the diverse rocks and soils which it presents, need to be briefly stated, since these circumstances control the development of the flora.

Minnesota lies in the middle of the North American continent, almost midway between the Atlantic and Pacific oceans and between the gulf of Mexico and the Arctic ocean, being distant a thousand miles or more from each of these grand bodies of water. The extent of the state from south to north is 380 miles, and its average width about 220 miles. It lies between 43° 30′ and 49° north latitude, and between 90° and 97° west longitude. Its area is 84,286 square miles.

The topographic features of Minnesota may be briefly summed up for its western three-quarters, as being a moderately undulating, sometimes nearly flat, but occasionally hilly expanse, gradually descending from the Coteau des Prairies and from the Leaf hills, respectively about 2000 and 1700 feet above the sea, to half that hight, or from 1000 to 800 feet, in the long flat basin of the Red river valley, and to the same hight along the valley of the Mississippi from Saint Cloud to Minneapolis. The only exceptions to this moderately undulating or rolling and rarely hilly contour, are the southeast part of the state where the Mississippi river and its tributaries are enclosed by bluffs from 200 to 600 feet high, and the northwest shore of lake Superior and the part of the state lying north of this lake and east of Vermilion lake. A very bold rocky highland rises 400 to 800 feet above lake Superior, within from one to five miles back from its shore-line, all along the distance of 150 miles from Duluth to Pigeon point, the most eastern extremity of Minnesota; while farther north are many hill-ranges, 200 to 500 feet higher, mostly trending from northeast to southwest or from east to west.

Lake Superior is 602 feet above the sea. The shore of this lake is the lowest land in Minnesota, while its highest land is the Mesabi range, which, south of Vermilion lake and eastward, is found by Prof. Winchell to exceed 2000 feet above sea-level. Itasca lake, the head of the Mississippi, is about 1500 feet above the sea; and this river at the southeast corner of Minnesota, 620 feet. Professor Winchell estimates the average elevation of the entire state to be approximately 1275 feet above the sea.

Climate is the most important of the factors by which a flora is modified, and this depends chiefly on geographic position, elevation and contour, if a sufficiently large area is taken into account. The warmest days of summer in Minnesota have a temperature of about 90° Fahrenheit, but such days are rare; and the greatest cold of winter is -- 30° or sometimes — 40°. The annual precipitation of moisture as rain and snow is from 25 to 30 inches. It is distributed somewhat equally throughout the year; damaging droughts or excessive rains seldom occur. In winter the snow in the south half of the state is commonly about a foot deep during two or three months; but farther north it attains an average depth of two or three feet.

The soil throughout the greater part of Minnesota consists of glacial drift, a mixture of clay, sand, gravel and boulders, clay being the principal ingredient, and boulders being usually infrequent. This deposit has been gathered from diverse formations of granite and gneiss, sandstone, limestone, and shales. Enriched at the surface by the decay of vegetation through centuries, the black soil on areas of the glacial drift has ordinarily a depth of one or two feet, and is very fertile. Other varieties of soil are found in tracts of gravel and sand, also generally quite fertile, which in many places border the large rivers and spread widely upon the region drained by the St. Croix and Crow Wing rivers and the upper Mississippi; in the lower alluvial bottomlands, which are mostly overflowed by the highest water of spring; on the cliffs of sandstone and limestone which border the rivers in the southeast part of the state; and on the hills of granite and crystalline schists north of lake Superior. Each peculiarity of soil affords a congenial location for plants which are absent or can not thrive elsewhere.

FOREST AND PRAIRIE.

The most important and conspicuous contrast presented by the [illegible] covering different parts of Minnesota, is its division in [illegible] covers the northeastern two-thirds of the state, approximately; while about one-third, lying at the south and southwest, and reaching in the Red river valley to the international boundary, as also the part of this valley farther north to lake Winnipeg, is prairie. The line dividing these areas, having an almost wholly timbered region on its northeast side, and a region on its southwest side that is chiefly grassland, without trees or shrubs, excepting in narrow belts along the larger streams and occasional groves beside lakes, runs as follows. Entering the state from the north about fifteen miles east of Emerson and St. Vincent, it extends south-southeastward to Red Lake Falls, thirty-six miles east of Grand Forks; thence southeast and south, to the east end of Maple lake; thence southwesterly along this lake, and from it south to the Sand Hill river; thence southeasterly to the White Earth Agency; thence southerly, by Detroit and Pelican Rapids, to Fergus Falls, which is situated half-way from the north to the south line of the state; thence southeasterly, in a less direct and regular course, through Douglas, Stearns, Meeker, McLeod and Sibley counties, to the Minnesota river, and along that stream to Mankato and South Bend; thence easterly by Janesville, Waterville and Morristown, to Faribault; thence northerly, turning backward, to Minneapolis and Anoka, the loop thus formed, enclosing Wright, Carver, Scott, Le Sueur, and parts of adjacent counties, being the boundary of the area well known as the Big Woods; thence easterly, passing through Ramsey and Washington counties to Stillwater and Hudson, where it enters Wisconsin.

The Big Woods are principally made up of the following species of trees, arranged by Prof. Winchell in the estimated order of their abundance: white or American elm, basswood, sugar maple, black and bur oaks, butternut, slippery or red elm, soft or silver maple, bitternut, white and black ash, iron-wood, wild plum, June-berry, American crab-apple, common poplar or aspen, large-toothed poplar, tamarack (in swamps), box-elder, black cherry, cottonwood (beside rivers and lakes), water beech, willows, hackberry, paper or canoe birch, yellow birch, white oak, and red cedar. Farther northward white, red and jack pines, black and white spruce, balsam fir and arbor-vitæ are conspicuous in the forest, intermingled with deciduous trees. Its shrubs include prickly ash, smooth sumach, frost grape, Virginian creeper, climbing bitter-sweet, red and black raspberries, choke-berry, prickly and smooth gooseberries, black currant, and species of cornel, wolfberry, honeysuckle, elder, viburnum, and hazel-nut.

The most abundant species of grass found upon the prairies of outhwestern Minnesota, are as follows: beard-grass (Andropogon urcatus, Muhl.), commonly here called "blue-joint." Indian grass Chrysopogon nutans, Benth.). muskit-grass (Bouteloua racemosa, Lagasca). and porcupine grass (Stipa spartea, Trin.), common on land neither very dry nor very moist; another species of beard-grass (Andropogon scoparius. Michx.), and a second muskit-grass (Bouteloua hirsuta. Lagasca), common on dry swells; the fresh-water cord-grass (Spartina cynosuroides, Willd.), in sloughs, making the principal mass of their hay; and rice cut-grass (Leersia oryzoides, Swartz), with the last. The prairies also bear a great variety of flowers, including numerous species of aster, golden-rod, sunflower, blazing-star or button snakeroot, and prairie clover, and the rose, lily, harebell, phlox, gerardia, fringed gentian, and many others. Sometimes the view across miles of the prairie is made yellow and purple by the multitude of sunflowers, blazing-stars, and gerardias.

LIMITS OF SPECIES.

Gradual changes in the flora are observable in crossing the continent either from east to west or from north to south. Many species disappear as the traveler advances, while others, not before present, are met with. A large majority of the plants in the Pacific states are not found east of the Mississippi; and such limitation prevails almost without exceptions between the arctic and tropical zones. The central position of Minnesota therefore makes this a most interesting field for the notation of the limits of species.

Among our forest trees, the white and red pine, arbor-vitæ ("white cedar"), yellow birch, black ash and sugar maple reach their western limit at the east side of the Red river valley.

No tree of exclusively western range extends east into Minnesota, and the only shrubs thus noted are Elæagnus argentea (silver-berry), Œnothera albicaulis and Amorpha microphylla; but about fifty herbaceous plants belonging to the flora of the western plains and the Rocky mountains, and not yet known to occur east of the Mississippi river, are found within our limits. These include species of Ranunculus, Aquilegia, Vesicaria, Linum, Astragalus, Oxytropis, Potentilla, Gaura, Peucedanum, Cymopterus, Gutierrezia, Aplopappus, Grindelia, Lepachys, Helianthus, Gaillardia, Senecio, Troximon, Plantago, Pentstemon, Orthocarpus, Echinospermum, ana. Asclepias, Suæda, Comandra, Euphorbia, Alli- ida. Buchloe. Elymus. and Beck-

A group of species, most notably represented in the pine and heath families, including our three pines, black spruce, balsam fir, tamarack and arbor-vitæ, huckleberry, blueberry, cranberry, snowberry, aromatic wintergreen or checkerberry, Labrador tea, and the clintonia and dwarf cornel, extends through the northeast part of the state to limits approximately coinciding with the Mississippi river, Red lake and the lake of the Woods.

The northern limits of yellow birch, bur oak, sugar maple and basswood here coincide nearly with the international boundary. The red cedar, cottonwood, hornbeam, white, black and red oaks, butternut, bitter-nut or swamp hickory, hackberry, box-elder, frost grape and prickly ash reach their general northern limits in the north half of this state; but several of them, like many herbaceous species of similar range, continue somewhat farther northwestward into Manitoba. The shell-bark hickory, black walnut, red mulberry and Kentucky coffee-tree attain their most northern range in the south half of the state.

The accompanying map shows the portions of Minnesota respectively occupied by forest and prairie, and the approximate limits of many of our trees.*

INTRODUCED PLANTS.

About eight per cent. of the plants growing without cultivation in this state are introduced species, distinguished in the catalogue by being printed in Italics. Most of them are such as follow civilized man, and grow in his cultivated fields and gardens, in spite of all efforts to banish them. Among the most notable introduced weeds in this state may be mentioned mustard, cow-herb and cockle, specially troublesome in wheat-fields; shepherd's purse, purslane, mallow, May-weed, burdock, mullein, pigweeds, tumble-weed, black bindweed, curled or yellow dock, sheep sorrel, hemp, barnyard-grass, and foxtail or pigeon-grass, frequently too plentiful in cultivated ground, about dwellings, by the road-side, or on pasture-land. The ox-eye daisy or white-weed, Canada thistle and cheat or chess are sparingly established, and may become very common bad weeds here, as farther east. It should be added that, besides these immigrants, a considerable number of weeds native to this country are also common, including species of Lepidium, Iva, Ambrosia, Helianthus and Stachys. Up to the present time, only about half as many naturalized and adventive species are known in Minnesota as in the eastern states, the difference being due to the shorter time since the settlement of this state and the proportionately less numerous opportunities for them to gain a foot-hold here.

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*Its method of delineation is similar to that of Dr. Robert Bell's map, recently published by the Geological Survey of Canada, showing the general northern limits of the principal forest trees of Canada.

Preliminary Remarks on the Catalogue.

Under each species is a statement whether it is abundant, common, frequent, infrequent, or rare, and whether its geographic range extends throughout the state or to limits which are indicated approximately; or, when the observations are insufficient for such statement, the localities where the species has been noted are mentioned, with the names of the observers.

The arrangement of families, genera and species strictly follows the fifth edition of Gray's *Manual*; and wherever a synonym replaces any name that occurs in the *Manual*, the latter also is given, enclosed by marks of parenthesis.*

The popular names are mostly such as appear in Gray's *Manual* and Wood's *Class-Book*; but in a few instances other names, in general use in this state, and often specially significant, are inserted.

Introduced species are distinguished from the indigenous, as before mentioned, by being Italicized.

For the species of our flora that are not described in Gray's *Manual*, which only included those found east of the Mississippi, descriptions are quoted from other authorities.† The present work thus supplies, with Gray's *Manual*, the means of identifying all the flowering plants and ferns known to occur in Minnesota.

Determinations of numerous difficult species, and notes concerning them, have been kindly supplied by Prof. Asa Gray, Mr. Sereno Watson, Mr. William Boott, Dr. George Engelmann, Mr. M. S. Bebb, Rev. T. Morong, and other specialists; and I am indebted to Dr. George Vasey for the description of the new Aristida basiramea, Engelmann, posthumously published.

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*The sources of improved nomenclature have been Watson's *Bibliographical Index to North American Botany* (Part I; Polypetalæ: 1878); Gray's *Synoptical Flora of North America* (Vol. II, Part I; Gamopetalæ after Compositæ: 1878); various papers by Professor Gray in the *Proceedings of the American Academy of Arts and Sciences;* Bailey's *Catalogue of North American Carices* (1884); Vasey's *Grasses of the United States* (1883); Eaton's *Ferns of North America* (1880); and notes in the *American Naturalist*, the *Botanical Gazette*, and the *Bulletin of the Torrey Botanical Club.*

†Chiefly from Watson's report on the Botany of King's *Exploration of the Fortieth Parallel;* Porter and Coulter's *Synopsis of the Flora of Colorado*; Rothrock's report on the Botany of Wheeler's *Surveys west of the One Hundredth Meridian*; Torrey and Gray's *Flora of North America;* and Gray's *Synoptical Flora.*

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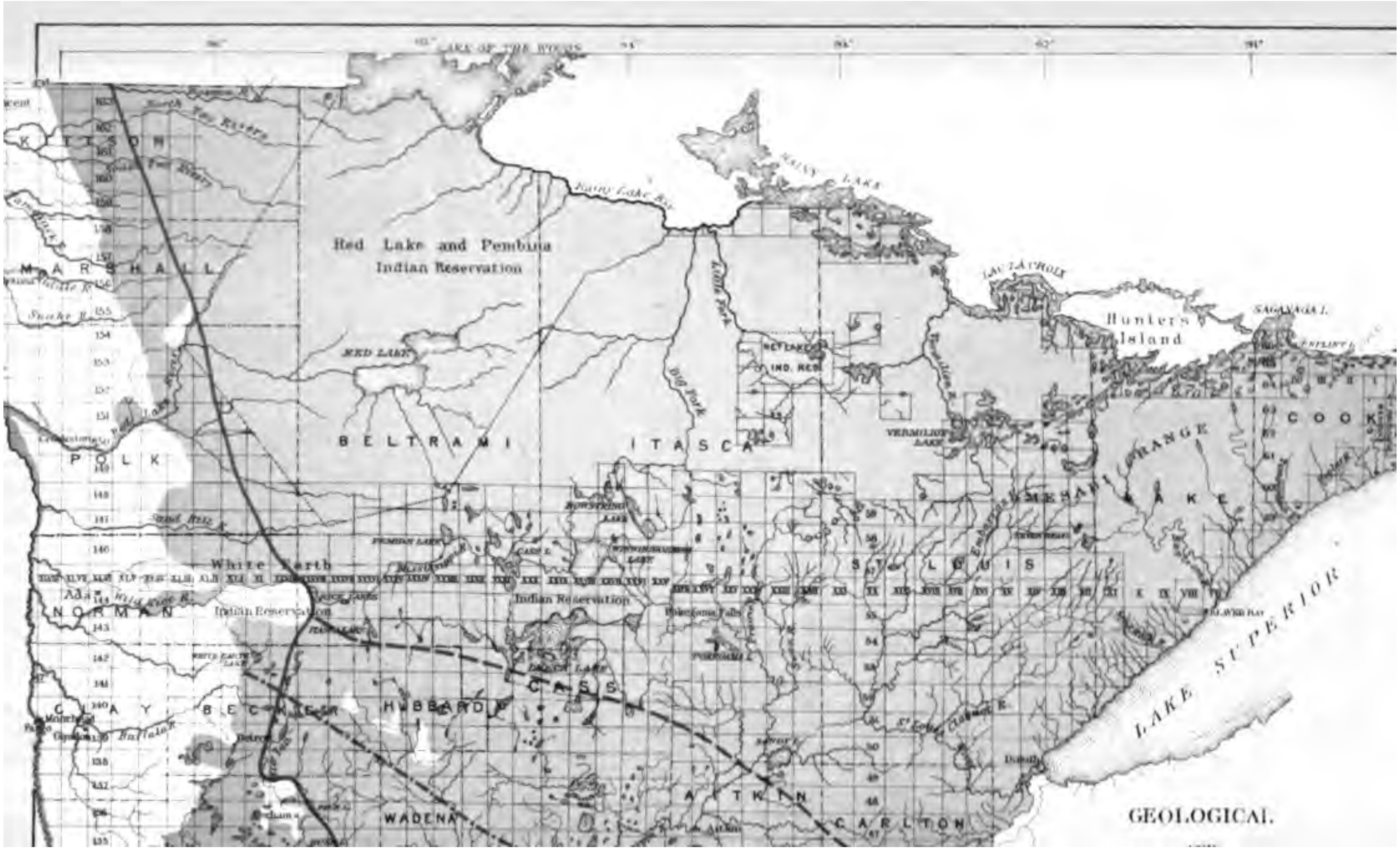
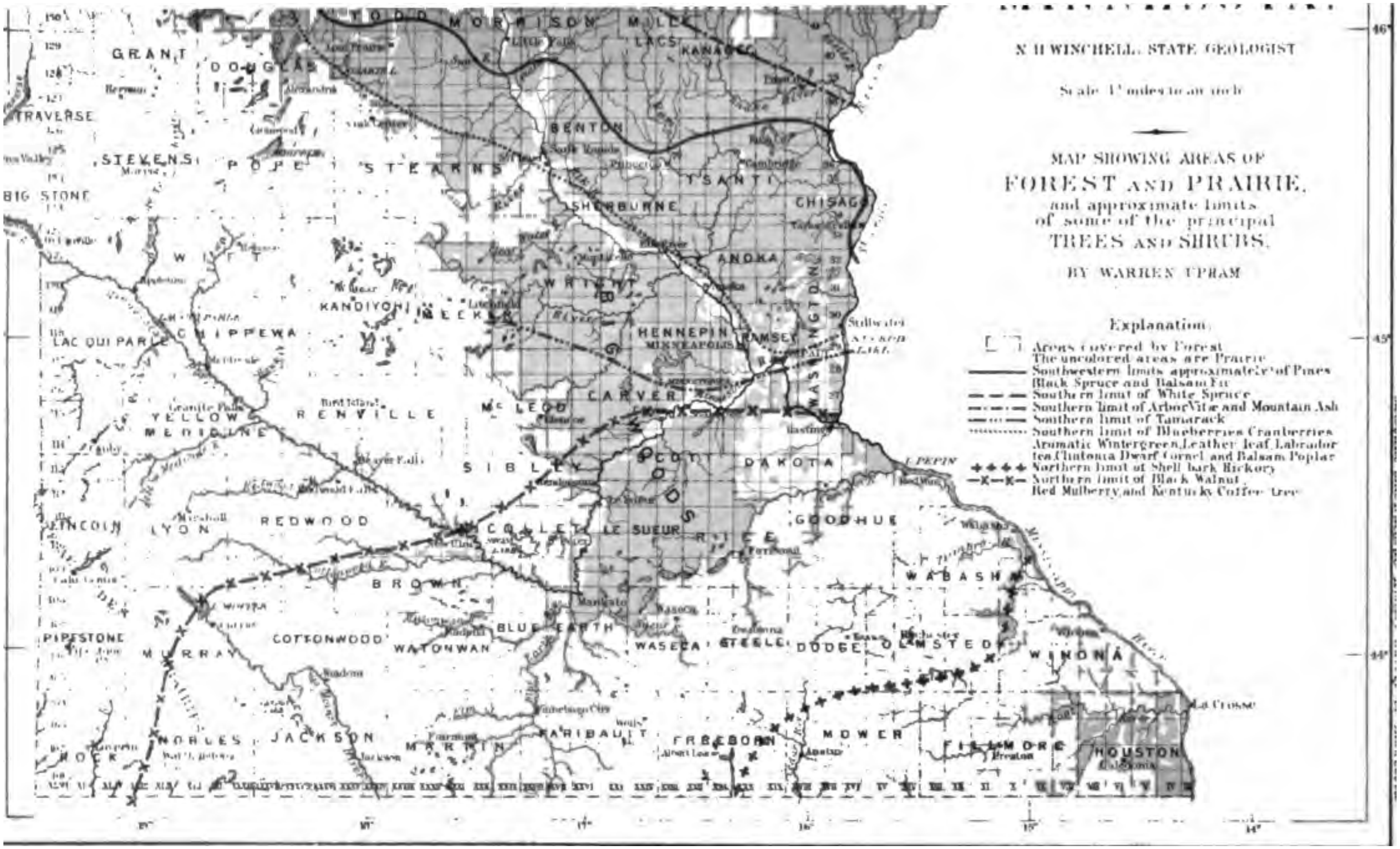


LAKE OF THE WOODS
RAINY LAKE
Rainy Lake Riv.
LAC LA CROIX
SAGANAGA L.
Hunters Island
Red Lake and Pembina
Indian Reservation
RED LAKE
Little Fork
Big Fork
NET LAKE IND. RES.
VERMILION LAKE
Vermilion R.
K I T T S O N
M A R S H A L L
P O L K
B E L T R A M I
I T A S C A
C O O K
L A K E
MESABI RANGE
S T. L O U I S
White Earth
Indian Reservation
N O R M A N
C L A Y
B E C K E R
H U B B A R D
C A S S
W A D E N A
A I T K I N
C A R L T O N
LEECH LAKE
WINNIBIGOSHISH LAKE
BOWSTRING LAKE
CASS L.
Pokegama Falls
Duluth
Moorhead
Detroit
Snake R.
Red Lake R.
Sand Hill R.
Wild Rice R.
Buffalo R.
St. Louis R.
LAKE SUPERIOR
GEOLOGICAL.



N. H. WINCHELL, STATE GEOLOGIST

Scale 17 miles to an inch

MAP SHOWING AREAS OF
FOREST AND PRAIRIE,
and approximate limits
of some of the principal
TREES AND SHRUBS.

BY WARREN UPHAM

Explanation.

▨	Areas covered by Forest The uncolored areas are Prairie
———	Southwestern limits approximately of Pines Black Spruce and Balsam Fir
— — —	Southern limit of White Spruce
—·—·—	Southern limit of ArborVitæ and Mountain Ash
—··—	Southern limit of Tamarack
········	Southern limit of Blueberries Cranberries Aromatic Wintergreen, Leather leaf, Labrador tea, Clintonia Dwarf Cornel and Balsam Poplar
✚✚✚✚	Northern limit of Shell bark Hickory
—×—×—	Northern limit of Black Walnut, Red Mulberry, and Kentucky Coffee tree

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CATALOGUE.

RANUNCULACEÆ. CROWFOOT FAMILY.

CLEMATIS, L. VIRGIN'S-BOWER.

C. verticillaris, DC. Virgin's-Bower.

Shady rocks at the head of lake St. Croix, *Parry;* St. Croix Falls, *Miss Field;* lake Pepin, *Miss Manning;* Winona County, *Holzinger*. Rare.

C. Virginiana, L. Common Virgin's-Bower.

Common, or abundant, southward ; frequent northward ; at Beaver Bay and summit of Black Point mountain north of lake Superior, *Roberts*.

ANEMONE, L. ANEMONE. WIND-FLOWER.

A. patens, L., var. **Nuttalliana,** Gray. Pasque-flower (i. e. Easter-flower). Pulsatilla. "Hartshorn-plant." "Headache-plant." "Gosling." "Prairie Smoke." "Crocus."

Abundant in all the prairie portion of the state. Its bruised leaves have a very pungent smell. This earliest flower of spring has received an unusual variety of popular names.

A. decapetala, L. (A. Caroliniana, Walt.) Carolina Anemone.

Frequent in the south part of the state, as in Hennepin, Goodhue, Blue Earth and Pipestone counties ; extending north to Saint Cloud, *Campbell, Mrs. Blaisdell*, and Appleton, Swift county, *Miss Elwell*. South.

A. parviflora, Michx. Small-flowered Anemone.

Minneapolis, *Winchell* ; upper Mississippi river, *Garrison* ; Red river valley, *Gedge*. North.

A. multifida, DC. Many-cleft Anemone. Red Wind-flower.

Dayton's bluff, Saint Paul, and between Saint Paul and Fort Snelling, *Miss Cathcart;* lake Superior to the lake of the Woods, *Macoun*. North.

A. cylindrica, Gray. Long-fruited Anemone.

Frequent throughout the state.

A. Virginiana, L. Virginian Anemone.

Common throughout the state.

A. dichotoma, L. (A. Pennsylvanica, L.) Pennsylvanian Anemone.

Common, often abundant, throughout the state.

A. nemorosa, L. Wind-flower. Wood Anemone.

Frequent, or common, throughout the state.

A. Hepatica, L. (Hepatica triloba, Chaix.) Liver-leaf. Round-lobed Hepatica.

Frequent southward, extending north at least to Duluth, *Miss Cathcart*, upper Mississippi river, *Garrison*, and Fergus Falls, *Leonard*.

A. acutiloba, Lawson. (H. acutiloba, DC.) Sharp-lobed Hepatica.

Common southward, extending north to Duluth, *Miss Cathcart*, and Mille Lacs county, *Upham*.

THALICTRUM, Tourn. MEADOW-RUE.

T. anemonoides, Michx. Rue-Anemone.

Often common southward, extending north to Stillwater, *Miss Field*, Anoka county, *Juni*, Stearns county, *Campbell*, and Fergus Falls, *Leonard*. Flowers nearly always purplish. (Abundant at Marine Mills, Washington county, often having more than one row of sepals and occasionally with all the stamens and pistils changed to sepals. *Miss Field*.)

T. dioicum, L. Early Meadow-Rue.

Common, or frequent, throughout the state.

T. purpurascens, L. Purplish Meadow-Rue.

Common, extending north at least to Morrison county, *Upham*, the St. Louis river, *Mrs. Herrick*, and in the Red river valley to Pembina, *Chickering*. (Specimens collected by *Prof. Gedge* at Glyndon, Clay county, have the shining upper surface of the very large leaflets waxy, as if varnished, but the lower surface minutely pubescent or glabrous, not waxy.)

T. Cornuti, L. Tall Meadow-Rue.

Common, or frequent, throughout the state.

RANUNCULUS, L. CROWFOOT. BUTTERCUP.

R. aquatilis, L., var. **stagnatilis,** DC. (R. divaricatus, Gray's *Manual*.) Stiff Water-Crowfoot.

Ponds near Mankato, *Leiberg*; Minneapolis, *Roberts, Herrick*; Stearns county, *Upham*; Alexandria, *Mrs. Terry*. Infrequent.

R. aquatilis, L, var. **trichophyllus,** Chaix. Common White Water-Crowfoot.

Frequent throughout the state.

R. multifidus, Pursh. Yellow Water-Crowfoot.

Common throughout the state.

R. ambigens, Watson. (R. alismæfolius, in *Manual*.) Water Plantain Spearwort.

Stearns county, *Campbell*. Infrequent. North.

R. Flammula, L. Small Spearwort.

Minneapolis, *Roberts*. Rare.

R. Flammula, L., var. **reptans,** Meyer. Creeping Spearwort.

Stillwater, *Leonard*; Minneapolis, *Roberts*; Anoka county and New Ulm, *Juni*; lake of the Woods, *Dawson*. Frequent.

R. Cymbalaria, Pursh. Sea-side Crowfoot.

Common, or frequent, throughout the state, excepting southeastward. Grand Portage, lake Superior, also at New Ulm (common), *Juni*; Little Rock, upper Minnesota river, *Parry*; Nicollet county, *Aiton*; Stearns county, and the Red river valley (common), *Upham*; Fergus Falls, *Leonard*; Worthington (common), *Foote*.

R. affinis, R. Br.* Rough-fruited Crowfoot.
Lake of the Woods, *Dawson*. Northwest.

R. affinis, R. Br., var. **cardiophyllus,** Gray.†
In the Red river valley at Pembina, *Chickering*. West.

R. rhomboideus, Goldie. Rhomboid-leaved Crowfoot. Dwarf Buttercup.
Frequent, or common, throughout the state.

R. abortivus, L. Small-flowered Crowfoot.
Frequent, or common, throughout the state.

R. abortivus, L., var. **micranthus,** Gray.
Minneapolis, *Winchell;* Pipestone county, *Mrs. Bennett*. Infrequent.

R. sceleratus, L. Cursed Crowfoot.
Frequent, or common, throughout the state.

R. recurvatus, Poir. Hooked Crowfoot.
Frequent throughout the state; reaching its northwestern limit at the lake of the Woods, *Macoun*.

R. Pennsylvanicus, L. Bristly Crowfoot.
Common throughout the state.

R. fascicularis, Muhl. Early Crowfoot.
Frequent, or common, throughout the south half of the state; infrequent northward.

R. repens, L. Creeping Crowfoot.
Abundant throughout the state.

R. repens, L., var. **hispidus,** Torr. & Gray.‡ (R. hispidus, Michx.)
Red river valley near Saint Vincent (in a swamp), *Dawson;* common from Manitoba westward, *Macoun*.

R. bulbosus, L. *Bulbous Crowfoot* or *Buttercups*.
Northfield, *Chaney;* Minneapolis, *Mrs. Terry*. Rare.

R. acris, L. *Tall Crowfoot* or *Buttercups*.
Infrequent, but noted at many places, as Lake City, Faribault, Northfield, Minneapolis, Northern Pacific Junction, Carlton county, and on the upper Mississippi river. "Becoming common in the eastern part of Manitoba," *Macoun*.

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*RANUNCULUS AFFINIS, R. Br. Radical leaves petioled, usually pedately multifid; cauline ones subsessile, digitate, with broadly linear lobes; stem erect, few-flowered; carpels with recurved beaks, in oblong cylindrical heads; more or less pubescent throughout. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*

†R. AFFINIS, R. Br., var. CARDIOPHYLLUS, Gray. Hirsutely pubescent, radical leaves round-cordate, undivided or many-cleft; cauline ones palmately many-cleft; flower 1 inch in diameter. *Porter and Coulter's Flora of Colorado.*

‡RANUNCULUS REPENS, L., var. HISPIDUS, Torr. & Gray. Stem erect, 1½ to 2 feet high, branching and, with the petioles, very pilose with spreading hairs; leaves trifoliate; leaflets distinctly petiolulate, oval, acute, laciniate; pedicels with the pubescence appressed; flowers as large as in *R. acris;* calyx appressed; carpels smooth, pointed with a very short style. *Torrey and Gray's Flora of N. A.*, vol. i, pp. 22 and 658.

C. palustris, L. Marsh Marigold. "Cowslip."

Abundant, or common, throughout most of the state ; less frequent westward.

COPTIS, Salisb. GOLDTHREAD.

C. trifolia. Salisb. Three-leaved Goldthread.

Common northward ; extending south to Minneapolis, *Roberts*, and Lake City (rare), *Miss Manning*.

AQUILEGIA, Tourn. COLUMBINE.

A. Canadensis, L. Wild Columbine. "Honeysuckle."

Common, or frequent, throughout the state.

Found, according to *Miss Babbitt*, with white flowers during several years in the south edge of the village of Little Falls, Morrison county, not associated at that locality with the usual type ; also some with flowers clear white, others cream-colored, and yet others of the ordinary kind, all growing together west of the Mississippi river, opposite to Little Falls, and likewise near Fort Ripley, in the same county.

A. brevistyla, Hook.* Short-styled Columbine.

In the Red river valley at Pembina, *Chickering*. West.

DELPHINIUM, Tourn. LARKSPUR.

D. exaltatum, Ait. Tall Larkspur.

Frequent through the south half of the state : extending north to the upper Mississippi river, *Garrison*, and Fergus Falls, *Leonard*.

D. tricorne, Michx. Dwarf Larkspur.

St. Paul, *Miss Cathcart;* Pipestone county, *Mrs. Bennett*. Infrequent. South.

D. azureum, Michx. Azure Larkspur.

Common southward ; extending north to the upper Mississippi river, *Garrison*, and Manitoba, *Macoun*.

D. Consolida, L. Field Larkspur.

Rarely adventive. Minneapolis, *A. W. Jones*.

HYDRASTIS, L. ORANGE-ROOT.

H. Canadensis, L. Orange-root. Yellow Puccoon.

Stearns county, *Garrison*. Rare. Southeast.

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*AQUILEGIA BREVISTYLA, Hook. Stems low, 6 to 8 inches high, spreading ; leaves bi-ternate ; leaflets 3-lobed, crenate, 6 to 9 lines [twelfths of an inch] long, crenatures ovate, rotund ; flowers small, blue, about 6 lines long, including the spur ; sepals oblong-ovate ; petals a little exceeding the stamens ; spurs hooked at the tip ; styles shorter, included. *Porter and Coulter's Flora of Colorado.*

ACTÆA, L. BANEBERRY.

A. spicata, L., var. **rubra,** Ait. Red Baneberry.

Common through the wooded portions of the state.

A. alba, Bigelow. White Baneberry.

Common, with same extent as the last. Berries frequently borne on slender, green pedicels.

NIGELLA, L. FENNEL-FLOWER.

N. Damascena, L.* *Fennel-flower.*

Escaped from cultivation, Mankato, *Leiberg.*

MENISPERMACEÆ. MOONSEED FAMILY.

MENISPERMUM, L. MOONSEED.

M. Canadense, L. Canadian Moonseed.

Frequent, often common, southward; extending north to Todd county and the northwest side of Mille Lacs, *Upham;* also in the Red river valley near Saint Vincent, *Dawson, Havard.* (Its long, slender, bitter, yellow root is used by the Sioux as a medicine, being called *Pejuta zizi;* and from this came the name Pejuta zizi, or Yellow Medicine river. *T. M. Young.*)

BERBERIDACEÆ. BARBERRY FAMILY.

BERBERIS, L. BARBERRY.

B. vulgaris, L. *Common Barberry.*

Spontaneous in old fields, Mankato, *Leiberg.*

CAULOPHYLLUM, Michx. BLUE COHOSH.

C. thalictroides, Michx. Blue Cohosh. Pappoose-root.

Common, or frequent, excepting northeastward.

PODOPHYLLUM, L. MAY-APPLE. MANDRAKE.

P. peltatum, L. May-Apple. Mandrake.

Common southeastward, extending north to Goodhue and Rice counties.

NYMPHÆACEÆ. WATER-LILY FAMILY.

BRASENIA, Schreber. WATER-SHIELD.

B. peltata, Pursh. Water-Shield.

Rainy lake and lake of the Woods, *Macoun;* Pleasant lake, near Saint Cloud,

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**Nigella Damascena,* L. Flowers bluish, rather large, surrounded and overtopped by a finely divided leafy involucre, like the other leaves; succeeded by a smooth inflated 5-celled pod, in which the lining of the cells separates from the outer part. *Gray's Field, Forest, and Garden Botany.*

Campbell; Benton county, *Upham;* shallow lakes near St. Croix river, *Parry;* White Bear lake, Ramsey county, *Simmons;* Minneapolis, *Herrick;* Excelsior, *Mrs. Terry;* Fergus Falls, *Leonard.* Infrequent.

NELUMBIUM, Juss. NELUMBO. SACRED BEAN.

N. luteum, Willd. Yellow Nelumbo. Water Chinquapin. "Rattle-box."

Upper Mississippi river, *Houghton;* lake Minnetonka (north end of Halsted's bay), *Roberts;* Mendota, *Mrs. Terry;* Mississippi river at Red Wing, *Sandberg*, near Dresbach, Winona county, *Winchell*, and at La Crosse, *Swezey*. Rare.

NYMPHÆA, Tourn. WATER-NYMPH. WATER-LILY.

N. odorata, Ait. Sweet-scented Water-Lily.

Plentiful in lakes along the international boundary northwest of lake Superior, *Winchell.* Abundant throughout Quebec and Ontario and extending westward to the lake of the Woods, *Macoun*. This species probably occurs also in central and southern Minnesota, in company with the following. *Mr. Leiberg* reports the examination of a great number of Nymphæa rootstalks, none of them bearing tubers, at Lake Crystal, Blue Earth county.

N. odorata, Ait., var. **minor**, Sims. Smaller Sweet-scented Water-Lily.

Tuttle lake, Otter Tail county (flowers only one and a half inches broad), *H. B. Ayres*. Rare.

N. tuberosa, Paine. Tuber-bearing White Water-Lily.

The white lilies common or frequent in ponds or lakes throughout the state, excepting near its west side, which have been called Nymphæa odorata, are believed to belong instead, for the most part, to this species. "Flowers large and delicately beautiful, fragrant." (*Wheeler and Smith.*) "This is really the water-lily of the Great lakes, as the true N. odorata seems to be confined to the northern waters, both lakes and rivers." (*Macoun.*)

NUPHAR, Smith. YELLOW POND-LILY. SPATTER-DOCK.

N. advena, Ait. Common Yellow Pond-Lily.

Common throughout the state.

N. luteum, Smith. Smaller Yellow Pond-Lily.

In small lakes east of the lake of the Woods, *Macoun.*

N. pumilum, Smith. (N. luteum, Smith, var. pumilum, Gray.) Small Yellow Pond-Lily.

Plentiful in Duluth harbor, *Roberts;* north shore of lake Superior, *Agassiz;* east shore of Rainy lake (rather rare), *Macoun;* Morrison county, *Miss Babbitt.*

SARRACENIACEÆ. PITCHER-PLANT FAMILY.

SARRACENIA, Tourn. SIDE-SADDLE FLOWER.

S. purpurea, L. Pitcher-Plant. Huntsman's Cup.

Common northward, extending south to Minneapolis, *Roberts*, *Winchell*; rare farther southeast

PAPAVERACEÆ. POPPY FAMILY.

PAPAVER, L. POPPY.

P. somniferum, L. *Common Poppy. Opium Poppy.*

Adventive in old gardens, Mankato, *Leiberg.*

SANGUINARIA, Dill. BLOOD-ROOT.

S. Canadensis, L. Blood-root.

Common, or abundant, throughout most of the state ; less frequent westward, as at Fergus Falls, *Leonard*, and Pembina, *Havard;* rare north of lake Superior, *Clark.*

FUMARIACEÆ. FUMITORY FAMILY.

DICENTRA, Bork. DICENTRA.

D. Cucullaria, DC. Dutchman's Breeches.

Common southward ; extending north at least to Stillwater, Anoka and Stearns counties, and Fergus Falls.

D. Canadensis, DC. Squirrel Corn.

Saint Paul, *Miss Cathcart ;* Minneapolis, *Twining ;* Faribault, *Miss Beane ;* Blue Earth county, *Leiberg.*

CORYDALIS, Vent. CORYDALIS.

C. glauca, Pursh. Pale Corydalis.

Common north of lake Superior, *Roberts;* extending south to Stearns and Benton counties, *Upham*, and to the falls of the St. Croix river, *Parry, Miss Field.*

C. flavula, DC. Yellow Corydalis.

Thomson, Duluth and Taylor's Falls, *Miss Cathcart;* upper Mississippi river, *Garrison;* Red river valley, *Gedge;* Blue Earth county, *Upham.*

C. aurea, Willd. Golden Corydalis.

Common, or frequent, through the north half of the state ; less frequent southward.

C. aurea, Willd., var. **micrantha,** Engelm.

Martin county, Minnesota, and Emmet county, Iowa (rare), *Cratty.*

FUMARIA, L. FUMITORY.

F. officinalis, L. *Common Fumitory.*

Adventive, Winona, *Holzinger.*

CRUCIFERÆ. MUSTARD FAMILY.

NASTURTIUM, R. Br. WATER-CRESS.

N. officinale, R. Br. *True Water-Cress.*

Stearns county, *Mrs. Blaisdell;* New Ulm, *Juni;* cold springs, Kasota, *Leiberg;* Tuttle's creek, Minneapolis, *Kassube;* lake Pepin, *Miss Manning.* Infrequent.

N. sinuatum, Nutt. Water-Cress.

Upper Mississippi river, *Garrison;* New Ulm, *Juni;* Pipestone county, *Leiberg;* lower Minnesota river, *Parry;* lake Pepin. *Miss Manning.*

N. sessiliflorum, Nutt. Water-Cress.

Lapham. Winona county, *Holzinger.* South.

N. palustre, DC. Marsh Cress.

Common, or frequent, throughout the state.

N. palustre, DC., var. **hispidum**, Fisch. & Mey.

Redwood Falls, *Pemberton.* Perhaps the prevailing form of the species in this state.

N. lacustre, Gray. Lake Cress.

Lapham. Southeast.

N. *Armoracia*, Fries. *Horse-radish.*

Adventive, Mankato, *Leiberg;* Northfield, *Chaney.*

DENTARIA, L. TOOTHWORT. PEPPER-ROOT.

D. diphylla, Michx. Two-leaved Pepper-root.

Freeborn and Blue Earth counties, *Upham;* lake Superior, *Whitney.* East.

D. laciniata, Muhl. Toothwort.

Frequent southeastward; extending northwest to Saint Paul, *Miss Cathcart,* Martin county, *Cratty,* and Fergus Falls, *Leonard.*

CARDAMINE, L. BITTER CRESS.

C. rhomboidea, DC. Spring Cress.

Frequent, or common, throughout the state.

C. pratensis, L. Cuckoo Flower.

Lake Superior to the sources of the Mississippi, *Houghton.* North.

C. hirsuta, L. Small Bitter Cress.

Common through the north half of the state; less frequent or rare southward. Glabrous specimens are sent by *Mr. Cratty* from Emmet county, Iowa. "A peculiar form grows on the height of land west of lake Superior, which seems to connect the species with the following variety," *Macoun.*

C. hirsuta, L., var. **sylvatica**, Gray.

Lake Minnetonka, *Roberts, Herrick;* Martin county (in woods), *Cratty,* determined by *Watson.*

ARABIS, L. ROCK CRESS.

A. lyrata, L. Rock Cress.

Common, or frequent, through the north half of the state; extending thus south to Red Wing (common), *Sandberg,* and Winona, *Holzinger;* wanting southwestward.

A. dentata, Torr. & Gray. Rock Cress.

Woods. Blue Earth county, *Leiberg;* Martin county (plentiful), *Cratty.* South.

A. lævigata, Poir. Smooth Rock Cress.

Lake Pepin, *Miss Manning;* Goodhue county, *Sandberg;* Minneapolis, *Twining, Roberts;* Isanti and Sherburne counties, *Upham;* Stearns county, *Garrison;* lake Superior, *Whitney.*

A. Canadensis, L. Sickle-pod.

Frequent through the south half of the state; extending north to the upper Mississippi river, *Garrison.*

A. perfoliata, Lam. Tower Mustard.

Poplar river, lake Superior, *Juni;* upper Mississippi river, *Garrison*; Stearns county, *Campbell;* Blue Earth county, *Leiberg*; lake Pepin, *Miss Manning.*

A. Drummondii, Gray. Drummond's Tower Mustard.

Frequent, often common, throughout the state.

THELYPODIUM, Endl. ROCK CRESS.

T. pinnatifidum, Watson. (Arabis hesperidoides, Gray). Rock Cress.

Northfield, *Chaney.* South.

BARBAREA, R. Br. WINTER CRESS.

B. vulgaris, R. Br., var. **stricta**, Regel. Winter Cress. Yellow Rocket.

Put in bay, lake Superior, *Juni;* upper Mississippi river, *Garrison;* Minneapolis, *Roberts.*

ERYSIMUM, L. TREACLE MUSTARD.

E. cheiranthoides, L. Worm-seed Mustard.

Frequent, or common, throughout the state.

E. asperum, DC.* Prairie Rocket. Western Wall-flower.

Abundant at Walhalla, Dakota, thirty miles west of the Red river, *Scott;* "a very prominent object on dry, gravelly soil throughout the prairie region" of Manitoba, *Macoun*, and ranging thence south to Mexico; doubtless extending sparingly into the west edge of Minnesota; also found by *Rev. J. Pemberton* at Redwood Falls, and by *Dr. Sandberg* on the limestone bluff of Belle creek opposite to the mill in Vasa, Goodhue county, occurring (like Vesicaria Ludoviciana in the same county) far east from its general limit.

E. parviflorum, Nutt.† Small-flowered Prairie Rocket.

Red river valley, *Dawson, Scott;* Minneapolis (beside railroad a mile southeast from the university: determined by *Mr. Watson* as this species; having light yellow "petals but half longer than the (3 to 4 lines long) sepals"; yet much branched near the base, numerous stems of nearly equal hight (1 to 1½ feet) being thus sent up from a single root; leaves narrowly lanceolate, mostly entire; pods about 1¼ inches long, beaked with a stout style, erect on short pedicels), *Upham.* West.

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*ERYSIMUM ASPERUM, DC. Biennial, canescent with short appressed hairs: stems solitary and simple, rarely branched above, 1 to 3 feet high, or less: leaves oblanceolate or narrowly spatulate; the cauline linear to linear-lanceolate, entire or sparingly repand with short acute teeth, 1 to 3 inches long: sepals narrow, 4 to 6 lines long, strongly gibbous: petals 8 to 12 lines long, light yellow to deep orange or purple: pods 1 to 4 inches long, a line wide, beaked with a stout style, ascending on stout spreading pedicels 3 lines long. *Brewer and Watson's Botany of California.*

†See description of ERYSIMUM PARVIFLORUM, Nutt., on next page.

S. canescens, Nutt., var. **brachycarpum**, Torr. & Gray.[*]
Red river valley, *Dawson*. North.

BRASSICA, Tourn. MUSTARD.

B. Sinapistrum, Boiss. *Charlock. Field Mustard.*
A common or frequent weed in grain-fields throughout the state; so troublesome in the Red river valley and southwestward that farmers allowing it to go to seed are subjected to a penalty by law.

B. alba, Gray. *White Mustard.*
Lake City, *Miss Manning;* Goodhue county, *Sandberg;* Blue Earth county, *Leiberg;* Stearns county, *Garrison*. Rare.

B. nigra, Koch. *Black Mustard.*
A common or frequent weed through the south half of the state.

B. campestris, L.[†] *Kale.*
Common in fields in Manitoba and around Winnipeg, *Macoun;* doubtless also in the Red river valley in this state.

DRABA, L. WHITLOW-GRASS.

D. arabisans, Michx. Whitlow-Grass.
North shore of lake Superior, *Juni*. Infrequent. North.

D. nemorosa, L., var. **hebecarpa**, Lindb. (D. nemoralis, Ehrh.)
About Rainy lake, *Drummond (Macoun)*. North.

ERYSIMUM PARVIFLORUM, Nutt. (E. lanceolatum, Hook.) Canescently scabrous with an appressed 2-parted pubescence; stem low (about a foot high) and nearly simple; leaves remarkably narrow, all linear or somewhat lanceolate, almost wholly entire, densely clustered at the base of the stem; siliques long, erect; stigma emarginate; flowers small, sulphur yellow; claws of the petals longer than the calyx. Distinguished from E. cheiranthoides by its more pubescent leaves, [longer] siliques and larger flowers. *Torrey and Gray's Flora of N. A.*

[*] SISYMBRIUM CANESCENS, Nutt., var. BRACHYCARPUM, Torr. & Gray. Lobes of the leaves somewhat acute, and, with the stem, furnished with minute stipitate glands; petals rather longer than the calyx; siliques scarcely attenuate at the base, somewhat longer than the pedicels. *Torrey and Gray's Flora of N. A.*

[†] *Brassica campestris*, L. Annual weed in cultivated fields and waste places; stem 1¼ to 3 feet high, with a few scattered, reversed hairs below; leaves somewhat fleshy and glaucous, lower lyrate-dentate, subciliate, 3 to 7 inches long, one-third as wide, the upper ones smaller, entire with rounded clasping lobes at base, tapering to an obtuse point; raceme 1 to 2 feet long; sepals erect, spreading; corolla yellow, 4 to 5 lines in diameter; siliques 1½ inches long, with the style ½ inch; seeds small, dark brown. *Wood's Class Book.*

D. nemorosa, L., var. **leiocarpa**, Lindb.* (D. lutea, Gilib. [DC.])

Stearns county, *Campbell;* near Glyndon, *Gedge;* Pipestone county, *Mrs. Bennett.* Rare. North and west.

D. Caroliniana, Walt. Whitlow-Grass.

Frequent southward, extending north to Stearns county, *Mrs. Blaisdell,* and west to Pipestone county, *Mrs. Bennett.*

D. Caroliniana, Walt., var. **micrantha**, Gray.

Common in Iowa, *Arthur* ; doubtless occurring also in Minnesota.

D. verna, L. Whitlow-Grass.

Saint Paul, *Miss Cathcart.* Rare. South.

ALYSSUM, Tourn. ALYSSUM.

A. calycinum, L. *Alyssum.*

Minneapolis, *Juni, Roberts;* Lake City, *Miss Manning;* Nicollet county, *Aiton.* Infrequent.

VESICARIA, Tourn. BLADDER-POD.

V. Ludoviciana, DC.† Bladder-pod.

Red river valley, *Scott,* determined by *Watson* ; also, Mississippi river bluffs, Red Wing, *Sandberg.* West.

CAMELINA, Crantz. FALSE FLAX.

C. sativa, Crantz. *False Flax.*

Minneapolis, *Juni;* along railways, Blue Earth county (introduced in flax-seed), *Leiberg;* Emmet county, Iowa (rare), *Cratty;* Pipestone county, *Mrs. Bennett;* Red river valley, *Dawson.* Infrequent.

SUBULARIA, L. AWLWORT.

S. aquatica, L. Awlwort.

Found in about three feet of water, on sandy bottom in Vermilion bay, on Eagle lake, Canadian Pacific railway, Manitoba, near Rainy lake ; abundant both in flower and fruit, Sept 13, 1882, *Fletcher, Macoun.* This rare species probably also occurs, and should be looked for, in northern Minnesota.

CAPSELLA, Vent SHEPHERD'S PURSE.

C. Bursa-pastoris, Mœnch. *Shepherd's Purse.*

A very abundant weed throughout the state.

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*DRABA NEMOROSA, L., var. LEIOCARPA, Lindb. Pubescent; stem branching, leafy, 6 to 15 inches high, very slender, sometimes branching from the base ; pubescence simple or forked ; leaves oval, cauline ones lanceolate, toothed ; flowers very small, yellow ; petals about twice as long as the calyx ; style none ; silicles oblong-elliptical, rather obtuse, glabrous, about 4 lines long, one-third to one-half the length of the slender spreading pedicels. *Porter and Coulter's Flora of Colorado.*

†VESICARIA LUDOVICIANA, DC. Canescent with a stellate pubescence ; stem 6 to 8 inches high, simple, or somewhat branched above ; radical leaves spatulate, entire, obtuse, cauline linear : flowers golden yellow ; petals obovate ; style slender, longer than the ovary and nearly as long as the obovate, globose, hairy silicle. *Porter and Coulter's Flora of Colorado.*

T. arvense, L. *Field Pennycress. Mithridate Mustard.*

Lapham. Pembina, *Havard.* "Abundant on the Red river near the older tlements" [in Manitoba]; "not yet common as far south as the forty-ninth parallel, rapidly spreading. A most noxious weed." *Dawson.*

LEPIDIUM, L. PEPPERWORT. PEPPERGRASS.

L. Virginicum, L. Wild Peppergrass.

Common, or frequent, throughout the state, excepting perhaps northward.

L. intermedium, Gray. Wild Peppergrass.

Abundant (petals usually wanting) throughout the state. Both species are na weeds.

CAKILE, Tourn. SEA-ROCKET.

C. Americana, Nutt. American Sea-Rocket.

"Abundant on the sandy south shore" of lake Superior, *Whitney;* at Thunder *Macoun;* doubtless also on the shore of lake Superior in Minnesota.

CAPPARIDACEÆ. CAPER FAMILY.

POLANISIA, Raf. POLANISIA.

P. graveolens, Raf. Heavy-scented Polanisia.

Common through the south half of the state, extending north at least to Dou county, *Mrs. Terry;* probably also in the Red river valley. (Two varieties are c mon at Minneapolis, one bearing yellowish, and the other pinkish flowers. *Herrick*

CLEOME. L. CLEOME. SPIDER FLOWER.

C. integrifolia, Torr. & Gray.[*] Cleome. Spider Flower.

Mankato. *Upham, Leiberg.* An immigrant from the plains west of Minnes Southwest.

VIOLACEÆ. VIOLET FAMILY.

VIOLA, L. VIOLET.

V. rotundifolia, Michx. Round-leaved Violet.

North of lake Superior (common), *Roberts;* upper Mississippi river, *Garri* extending south to Minneapolis, *Griswold*, and Saint Paul, *Miss Cathcart.*

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[*] CLEOME, L. Sepals distinct or somewhat united. Stamens 6 or rarely 4. T minute. Pod linear or oblong, subsessile or stipitate. Annual herbs, or shrubs, digitate or simple leaves and racemed or solitary flowers. *Benth. & Hook.*

CLEOME INTEGRIFOLIA, Torr. & Gray. Annual, somewhat glaucous, 2 to 3 feet h widely branching; leaves 3-foliolate; leaflets lanceolate (the lowermost oblong), en submucronate; racemes sometimes nearly 1 foot long; flowers large, showy, red purple, rarely white; sepals united to the middle, persistent; segments triangu acuminate; petals with very short claws; stamens equal; pods oblong-linear, c pressed, much longer than the stipe. *Porter and Coulter's Flora of Colorado.*

V. lanceolata, L. Lance-leaved Violet.
Near Saint Paul, *Mrs. Terry*. Rare. South.

V. primulæfolia, L. Primrose-leaved Violet.
Near Saint Paul, *Mrs. Terry;* Pipestone county, *Mrs. Bennett.* Rare. South.

V. blanda, Willd. Sweet White Violet.
Frequent throughout the state.

V. renifolia, Gray.* Kidney-leaved Violet.
Abundant in cedar swamps and mossy woods from northern New England through Canada and Manitoba to British Columbia, *Macoun;* doubtless in northern Minnesota.

V. Selkirkii, Pursh. Selkirk's Violet. Great-spurred Violet.
Upper Mississippi river, *Garrison.* Rare. North.

V. cucullata, Ait. Common Blue Violet.
Common, often abundant, throughout the state.

V. cucullata, Ait., var. **palmata,** Gray. Hand-leaf Violet.
Lake Pepin, *Miss Manning* ; Minneapolis, *Herrick, Griswold;* Worthington (common), *Foote.*

V. cucullata, Ait., var. **cordata,** Gray.
Near Minneapolis, *Mrs. Terry;* Nicollet county, *Aiton.*

V. sagittata, Ait. Arrow-leaved Violet.
Frequent southeastward ; extending north to Minneapolis, *Roberts,* Marine Mills, Washington county, *Miss Field,* and Anoka county, *Juni;* and northwest to Fergus Falls, *Leonard.*

V. delphinifolia, Nutt. Larkspur Violet.
Frequent, often common, through the south half of the state ; extending north to Morrison county, *Upham,* and along the Red river valley.

V. pedata, L. Bird-foot Violet.
Abundant, or common, through the south half of the state and in the Red river valley.

V. canina, L., var. **sylvestris,** Regel. Dog Violet.
Frequent, but not common, throughout most of the state ; rare southward.

V. striata, Ait. Pale Violet.
Hennepin county, *Herrick;* Alexandria, *Mrs. Terry.* Infrequent.

V. Canadensis, L. Canada Violet.
Frequent northward, and found more rarely throughout the south half of the state; extending southwest to Martin county (very scarce), *Cratty,* and Pipestone county, *Mrs. Bennett.* Flowers light pink.

V. pubescens, Ait. Downy Yellow Violet.
Common, or frequent, throughout the state.

V. pubescens, Ait., var. **eriocarpa,** Nutt.
Frequent in the vicinity of Hesper, Iowa, at the southern boundary of Minnesota, adjacent to Houston and Fillmore counties, *Mrs. Carter.*

V. tricolor, L. *Pansy. Heart's Ease.*
Rarely adventive, Stearns county, *Garrison.*

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*VIOLA RENIFOLIA, Gray. Rootstock and flowers as in V. blanda, or somewhat larger; leaves reniform (when fully grown usually two inches wide), on both sides, as also the petiole, villous-pubescent ; scape pubescent. *Gray* in *Proc. Am. Acad. of Arts and Sciences,* 1870.

H. Canadense, Michx. Frost-weed.

Common, or frequent, throughout the state, excepting near its west side and far northward; extending north to the upper Mississippi river, *Garrison*, and Fort Francis, Rainy river, *Macoun*.

HUDSONIA, L. HUDSONIA.

H. tomentosa, Nutt. Downy Hudsonia.

Fifteen-mile point, Rainy lake, and Hungry Hall, entrance to the lake of the Woods, *Macoun;* Minnesota point, near Duluth, and on sand dunes in Anoka county, *Roberts*; on sand hills in section 21, Orrock, Sherburne county (plentiful, with short-peduncled flowers and narrow leaves), *Upham;* near Rockford, Wright county, *Hatch;* barren ridges of the St. Croix, *Parry;* Castle Rock, Dakota county, *Geyer;* White Rock, Goodhue county, *Sandberg;* lake Pepin, *Miss Manning*. Local.

LECHEA, L. PINWEED.

L. minor, Walt. Small Pinweed.

Sturgeon lake (near the international boundary east of Rainy lake), *Macoun;* upper Mississippi, *Houghton;* St. Croix river, *Parry;* Steele county, *Upham*.

DROSERACEÆ. SUNDEW FAMILY.

DROSERA, L. SUNDEW.

D. rotundifolia, L. Round-leaved Sundew.

Common, or frequent, northward; extending south to Minneapolis, *Roberts*.

D. intermedia, Drev. and Hayne, var. **Americana**, DC. (D. longifolia, in *Manual*.) Long-leaved Sundew.

Similar in range with the last, but less frequent. North shore of lake Superior at Little Marais, *Juni;* between the lake of the Woods and Red river (common), *Dawson;* extending south to sections 17 and 19, Ham Lake, Anoka county (with the leaves scattered along the stem or caudex), *Roberts*.

D. linearis, Goldie. Slender Sundew.

Lake Superior to Roseau river, *Burgess*, *Macoun;* extending south to Hennepin county (frequent), *Roberts*.

HYPERICACEÆ. ST. JOHN'S-WORT FAMILY.

HYPERICUM, L. ST. JOHN'S-WORT.

H. pyramidatum, Ait. Great St. John's-wort.

Rare or local northward, but frequent southward; extending north to Todd county, *Upham*, the upper Mississippi and Minnesota rivers, *Parry*, and northwest to the plains of the Saskatchewan, *Bourgeau*, *Macoun*.

[H. Kalmianum, L., probably occurs on the north shore of lake Superior in this

H. prolificum, L. Shrubby St. John's-wort.

Vasa, Goodhue county, *Sandberg.* Southeast.

H. ellipticum, Hook. St. John's-wort.

Lapham. Upper Mississippi river, *Garrison.* [Devil's lake, Dakota, *Geyer.*] Infrequent. North.

[*H. perforatum*, L., may be expected as a weed southeastward.]

H. corymbosum, Muhl. St. John's-wort.

Lapham. Lake Pepin, *Miss Manning;* Hesper, Iowa, adjacent to the south line of Houston and Fillmore counties, *Mrs. Carter.* Rare.

H. mutilum, L. Slender St. John's-wort.

Throughout the state; common northward, less frequent southward.

H. mutilum, L. var. **gymnanthum**, Gray.

Minneapolis, *Roberts.*

H. Canadense, L. Canadian St. John's-wort.

St. Croix river, *Parry;* Stearns county, *Campbell;* Sibley county, *Leonard;* Martin county (rare), *Cratty.*

H. Canadense, L., var. **major**, Gray.

Lake Superior, *Robbins*, and in Iowa, *Arthur;* doubtless also in Minnesota.

ELODES, Adans. MARSH ST. JOHN'S-WORT.

E. Virginica, Nutt. Marsh St. John's-wort.

Throughout the state; common northward, frequent southward.

CARYOPHYLLACEÆ. PINK FAMILY.

SAPONARIA, L. SOAPWORT.

S. officinalis, L. *Common Soapwort. Bouncing Bet.*

Blue Earth county, *Leiberg;* Lake City, *Miss Manning;* Wabasha, *Gibson.*

S. Vaccaria, L. (*Vaccaria vulgaris*, Host.) *Cow-Herb.*

Seldom plentiful, but reported at many places throughout the state. *Mr. Leiberg* writes: "This is becoming a common weed in the grain-fields of Blue Earth county, where the farmers call it 'cockle', and complain very much of it. It will doubtless become as plentiful as the true cockle (*Lychnis Githago*). Most of the seeds are just small enough to pass through a wheat-screen, and they can thus be separated; but, as the largest seeds will be left in whenever the grain is cleaned, the result will be that in time, through this process of selection, the seeds can no more be cleaned out of the wheat than true cockle."

SILENE, L. CATCHFLY. CAMPION.

S. stellata, Ait. Starry Campion.

Common through the south part of the state; extending north at least to Minneapolis, *Herrick*, and Redwood Falls, *Miss Butler.*

S. nivea, DC. Campion.

Upper Mississippi river, *Garrison;* Goodhue county, *Sandberg;* Hesper, Iowa, adjoining Houston county, *Mrs. Carter.* Rare. Southeast.

S. Virginica, L. Fire Pink. Catchfly.

Nicollet county, *Leiberg.* Rare. Southeast.

S. antirrhina, L. Sleepy Catchfly.
Frequent or common throughout the state.

S. noctiflora, L. *Night-flowering Catchfly.*
Frequent throughout the state.

LYCHNIS, Tourn. LYCHNIS. COCKLE.

L. vespertina, Sibth. *Evening Lychnis.*
Minneapolis, *Juni, Kassube, Moulton.* Rare.

L. Githago, Lam. *Corn Cockle.*
A common weed in wheat-fields throughout the state.

ARENARIA. L. SANDWORT.

A. serpyllifolia, L. *Thyme-leaved Sandwort.*
Northfield, *Cheney.* Rare.

A. Michauxii, Hook. (A. stricta, Michx.) Strict Sandwort.
Growing on detached rocks, head of lake St. Croix, *Parry;* Lake of the Woods, *Macoun.* Rare.

A. lateriflora, L. Showy Sandwort.
Frequent throughout the state.

STELLARIA. L. CHICKWEED. STARWORT.

S. media, Smith. *Common Chickweed.*
Frequent throughout the state.

S. longifolia, Muhl. Long-leaved Stitchwort.
Common throughout the state.

S. longipes, Goldie. Long-stalked Stitchwort.
Minneapolis, *Griswold, Kassube;* Anoka county and Duluth, *Juni.* [Devil's lake, Dakota, *Geyer.*] North.

S. crassifolia, Ehrh. Starwort.
Cannon Falls, Goodhue county, *Blake, Sandberg;* Minneapolis (plentiful in ditches in swamps), *Roberts, Upham;* and northward.

S. borealis, Bigelow. Northern Stitchwort. Starwort.
Common, or frequent, in the north half of the state. [The var. alpestris, Gray, has been found on the north side of lake Superior, at Pie island, by *Macoun.*]

CERASTIUM, L. MOUSE-EAR CHICKWEED.

C. viscosum, L. (*C. vulgatum,* L., in *Manual.*) *Mouse-ear Chickweed.*
Winona county, *Holzinger;* lake Pepin, *Miss Manning.* [Lake Superior, *Whitney.*]
Infrequent.

C. vulgatum, L. (*C. viscosum,* L., in *Manual.*) *Large Mouse-ear Chickweed.*
Common, or frequent, throughout the state, excepting perhaps westward.

C. nutans, Raf. Nodding Mouse-ear Chickweed.
Frequent, or common, throughout the state, excepting southwestward.

C. oblongifolium, Torr. Mouse-ear Chickweed.
Winona county, *Holzinger;* Fergus Falls, *Leonard.* Rare. Southeast.

C. arvense, L. Field Chickweed.

Frequent, or common, through the north half of the state and southwestward ; rare southeastward.

SAGINA, L. PEARLWORT.

S. nodosa, E. Meyer. Pearlwort.

North shore of lake Superior, doubtless in Minnesota ; Isle Royale, *Whitney;* island of St. Ignace, *Macoun.*

PARONYCHIEÆ. WHITLOW-WORT FAMILY.

ANYCHIA, Michx. WHITLOW-WORT. NAILWORT.

A. dichotoma, Michx. Forked Chickweed. Whitlow-wort.

Lapham. Infrequent.

FICOIDEÆ. ICE PLANT FAMILY.

MOLLUGO, L. INDIAN-CHICKWEED.

M. verticillata, L. Carpet-weed.

Common, or frequent, southward. Exposed rocks and sandy fields, St. Croix river, *Parry;* abundant in Hennepin county on sandy river-banks, appearing indigenous, *Roberts.*

PORTULACACEÆ. PURSLANE FAMILY.

PORTULACA, Tourn. PURSLANE.

P. oleracea. L. *Common Purslane.* *"Pusley."*

A very common garden weed.

P. retusa, Engelm.* Western Purslane.

Upper Minnesota river, *Parry*; Yellow Medicine county, *Upham*; upper Mississippi river, *Garrison.* (Surely indigenous ; yet possibly to be referred to the foregoing species.) West.

TALINUM, Adans. TALINUM.

T. teretifolium, Pursh. Talinum.

Rare, occurring only on ledges of rock (trap, syenite, granite and quartzite); absent far northward. Taylor's Falls (of St. Croix river), *Houghton, Miss Field*; Duluth, *Miss Cathcart*; Watab, Benton county, and at numerous places in Stearns and Morrison counties, *Upham*; upper Minnesota river, *Parry*; Redwood Falls, *Miss Butler*; "plentiful on most of the ledges in Rock and Pipestone counties (a handsome little plant, extremely easy of cultivation)," *Leiberg.*

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*PORTULACA RETUSA, Engelm. Like *P. oleracea*, L., but greener, and the stem more ascending, sometimes covering a space several feet in diameter ; leaves usually smaller than the common species; sepals obtuse, broadly carinate-winged ; petals yellow ; stigmas 3 or 4 ; capsule $2\frac{1}{2}$ to 3 lines long, broader in proportion ; seeds more strongly tuberculate than in *P. oleracea. Brewer and Watson's Botany of California.*

CLAYTONIA, L. SPRING-BEAUTY.

C. Virginica, L. Narrow-leaved Spring-Beauty.

Throughout the state, but rare in most portions; frequent, or common, southeastward.

C. Caroliniana, Michx. Wide-leaved Spring-Beauty.

Lake City, *Mrs. Ray*. Southeast.

MALVACEÆ. MALLOW FAMILY.

MALVA, L. MALLOW.

M. rotundifolia, L. *Common Mallow.*

Common southward, and as far north as Morrison and Todd counties, *Upham*; but not yet common westward.

M. sylvestris, L. *High Mallow.*

Fort Francis, Rainy river, *Macoun*; Minneapolis, *Herrick*; Goodhue county, *Sandberg*; lake Pepin, *Miss Manning*; Blue Earth county, *Leiberg*.

M. crispa, L. *Curled Mallow.*

Adventive, Lake City, *Miss Manning*.

CALLIRRHOE, Nutt. CALLIRRHOE.

C. triangulata, Gray. Callirrhoe.

Lapham. South.

NAPÆA, Clayt. GLADE MALLOW.

N. dioica, L. Glade Mallow.

Lapham. Vasa, Goodhue county, *Sandberg*. Rare. Southeast.

MALVASTRUM, Gray. FALSE MALLOW.

M. coccineum, Gray. Prairie Mallow.

Minnesota, *Gray's Manual*. West. Its eastern limit scarcely reaches into this state.

ABUTILON, Tourn. INDIAN MALLOW.

A. Avicennæ, Gærtn. *Velvet-Leaf.*

Anoka, Hennepin, Ramsey, Wabasha and Blue Earth counties. Infrequent.

HIBISCUS, L. ROSE-MALLOW.

H. militaris, Cav. Halberd-leaved Rose-Mallow.

Banks of the Mississippi river between Saint Paul and Mendota (abundant), *Mrs. Terry*. South.

H. Trionum, L. *Bladder Ketmia.* *Flower of an Hour.*

Adventive, Minneapolis, *Kassube*, *Upham*; Goodhue county, *Sandberg*; Martin county, *Gedge*. [This "has become abundant in many parts" of Nebraska, *Aughey*.]

TILIACEÆ. LINDEN FAMILY.

TILIA, L. LINDEN. BASSWOOD.

T. Americana, L. Basswood. Bass. Linden. Lime Tree. Whitewood.

Very abundant in the Big Woods, and generally common throughout the state; not found near the Minnesota shore of lake Superior, but frequent north of this lake, on maple ridges 400 feet and more above it, attaining a hight of 70 feet and diameter of 20 inches, *Clark*; also, not found in Rock county, but very plentiful at Bear lakes in Murray county, *Upham*; extending north to Basswood lake on the international boundary, *Winchell*.

[The northern limit of this species is found just south of Thunder bay, from which it nearly follows the international boundary to the lake of the Woods. It extends farther north in Manitoba, nearly to lake Winnipeg, and northwest to Fort Ellice. *Dr. Robert Bell.*]

(The leaves of this and many other species of trees, in their first few years of growth from the seed, are often remarkably large. The following measurements were made in Todd county, September 16th: leaf of basswood, blade, 14½ inches long and 12 inches wide, borne on a petiole 3 inches long; of large-toothed aspen, blade, 10 by 7½, and petiole, 4 inches; of balsam poplar, blade, 11 by 7, and petiole, 2 inches; and of elm, blade, 9 by 6 inches, with petiole only a half inch long.)

"Basswood lumber is much used in cabinet work for boxes, shelves, etc., whenever a wood is desired which is soft and easily worked, and, at the same time, tough and not liable to split." It decays more quickly than most kinds of lumber, when exposed to the weather, unless it is thoroughly painted; but is sufficiently durable, if kept dry.

LINACEÆ. FLAX FAMILY.

LINUM, L. FLAX.

L. perenne, L.[*] Wild Flax. Prairie Flax.

At Pembina, and thence westward, *Chickering*; Stearns county, *Mrs. Blaisdell*. West.

L. sulcatum, Riddell. Wild Flax.

Common from Minneapolis, *Roberts*, southward, and westward to the Red river valley, *Upham*; Pipestone quarry, *Mrs. Bennett*.

L. rigidum, Pursh.[†] Wild Flax.

From Winona county, *Winchell*, Minneapolis, *Twining*, and Anoka county, *Juni*, westward to Pipestone county, *Leiberg*, and the Red river valley (common in Clay county), *Upham*. South and west.

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[*] LINUM PERENNE, L. Perennial, glabrous; leaves scattered, linear, acute; flowers nearly opposite the leaves and terminal; peduncles becoming elongated and nodding in fruit; sepals oval with membranous margins, shorter than the globose capsule; petals free, blue, retuse, 3 to 4 times exceeding the calyx; styles 5; capsule 5-celled, with bearded dissepiments. Stems ½ to 3 feet high; flowers large. May to September. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*

[†] LINUM RIGIDUM, Pursh. Dwarf; glaucous; styles united almost to the top. *Gray's Manual.*—Stems 5 to 15 inches high, angled, much branched; branches strict, ascending; leaves alternate, linear, pungently acute, rigid, with scabrous margins; flowers panicled or corymbose; pedicels thickened at the end, and forming an exterior cup-shaped calyculus; sepals ovate-lanceolate, cuspidate, strongly 3-nerved, glandular spinulose-scabrous on the margins, longer than the globose capsule; petals sulphur-yellow. *Porter and Coulter's Flora of Colorado.*

Sometimes adventive in fields: Minneapolis; Blue Earth county; Redwood Fal Luverne.

GERANIACEÆ. GERANIUM FAMILY.

GERANIUM, L. CRANESBILL.

G. maculatum, L. Wild Cranesbill.

Common, often abundant, through the south half of the state; extending northw to Clay county, *Gedge*, the upper Mississippi river, *Garrison*, and the mouth of Ra river, *Macoun*.

G. Carolinianum, L. Carolina Cranesbill.

Common, or frequent, throughout the state; most plentiful northward.

G. Robertianum, L. Herb Robert.

Falls of the St. Croix, *Parry*; Fergus Falls, *Leonard*; extending west to the lak the Woods, *Macoun*. North.

ERODIUM, L'Her. STORKSBILL. HERON'S-BILL.

E. cicutarium, L'Her. Storksbill. Heron's-bill.

Minneapolis, *Juni, Kassube, Roberts*. Rare. An abundant weed in the Pac states and in some districts eastward.

IMPATIENS, L. BALSAM. JEWEL-WEED. TOUCH-ME-NOT.

I. pallida, Nutt. Pale Touch-me-not.

Throughout the state; in many portions infrequent or rare; common at New U *Juni*, and in Blue Earth county, *Leiberg*; abundant in Martin county, *Cratty*, and the south shore of Red lake, *Miss Babbitt*.

I. fulva, Nutt. Spotted Touch-me-not.

Common throughout the state. ("At Beaver Bay a spotless variety, with less flected spur, was common and grew intermingled with the ordinary form, without sh ing any signs of intergradation." *Roberts*.)

OXALIS, L. WOOD-SORREL. OXALIS.

O. Acetosella, L. Common Wood-Sorrel.

Common north of lake Superior, *Roberts*; lake of the Woods, *Macoun*; extenc northwest to the Saskatchewan, *Richardson*. North.

O. violacea, L. Violet Wood-Sorrel.

Common through the south half of the state to Pipestone county, *Mrs. Benı* extending north to the upper Mississippi river, *Garrison*, and in the Red river valle east to Clay county, *Gedge*. (*Herrick* reports, besides the type, a variety that b white flowers, occurring quite frequently in the vicinity of Castle Rock, Dakota cou and *Miss Babbitt* finds the same at Little Falls. Succulent flower-bearing scapes, accompanied by leaves, are occasionally seen in September [*Upham*]. "The u occurrence of a white, carrot-shaped root beneath the ordinary scaly bulb" of species is noticed by *Roberts*, in the *American Naturalist* for August, 1879. See *Am. Nat.*, vol. xvi, pp. 13-19.)

O. corniculata, L., var. **stricta**, Sav. (O. stricta, L.) Yellow Wood-S

RUTACEÆ. RUE FAMILY.

XANTHOXYLUM, Colden. PRICKLY ASH.

X. Americanum, Mill. Northern Prickly Ash. Toothache-tree.

Very abundant southward; extending north to Pine, Aitkin, Cass and Polk counties.

PTELEA, L. SHRUBBY TREFOIL. HOP-TREE.

P. trifoliata, L. Shrubby Trefoil. Hop-tree. Wafer Ash.

Lapham. Southeast.

ANACARDIACEÆ. CASHEW FAMILY.

RHUS, L. SUMACH.

R. typhina, L. Staghorn Sumach.

Limited to the east side of the state and the region from the upper Mississippi river northeastward, as follows: in Houston and Fillmore counties, rare; in Winona county the most frequent species on the bluffs of the Mississippi ("at Winona samples were seen eight inches in diameter", *Winchell*), but rare farther west; common in Ramsey and Hennepin counties, extending west into the Big Woods, and to Martin county, *Cratty;* rare in Benton county; common in Pine county and westward to Mille Lacs, Little Falls and lake Alexander, Morrison county; at Fish-hook lake in southwestern Cass county, *Garrison*; and occasional northeastward, being reported by *Clark* at Sandy lake, Fond du Lac, Grand Portage and Pigeon river.

R. glabra, L. Smooth Sumach.

Common throughout the state, excepting north of lake Superior, where it is rare.

R. copallina, L. Dwarf Sumach.

Houston county, near La Crescent, also in Winona county, *Winchell*; lake Pepin, *Miss Manning*; Goodhue county, *Sandberg*; Saint Paul, *Miss Cathcart*; Blue Earth county, *Leiberg*; Worthington, *Foote*; Pipestone county, *Mrs. Bennett*. Rare. South.

R. venenata, DC.* Poison Sumach. Poison Dogwood.

Observed, like the preceding, in Houston county, near La Crescent, and in Winona county, by *Prof. Winchell*; Hennepin county, *Simmons*; Anoka county, *Juni*; upper Mississippi river, *Garrison*. Rare.

R. Toxicodendron, L. Poison Ivy. Poison Oak.

Common, often abundant, throughout the state. (Erect or decumbent, 1 to 3 feet high; not climbing.]

R. Toxicodendron, L., var. **radicans**, Torr.* Climbing Poison Ivy.

This variety (or species) occurs sparingly in the southeast part of the state. *Mrs. Carter*, *Miss Manning*.

R. aromatica, Ait. Fragrant Sumach.

Maligne river (near the international boundary east of Rainy lake). *Macoun*. Rare.

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*RHUS TOXICODENDRON, L., var. RADICANS, Torr. (R. radicans, L.) Stems climbing by means of innumerable radicating tendrils; leaflets 3, ovate, dark green, smooth and shining, entire, the lowest rarely angular; flowers greenish, racemed in axillary panicles; berries dull white. A vigorous woody climber, ascending trees and other objects 10 to 40 or 50 feet. The stem becomes 1 to 2 inches [or more] in thickness, covered with a greenish, scaly bark, and throws out all along its length myriads of thread-like rootlets, which bind it firmly to its support. *Wood's Class-Book.*

VITACEÆ. VINE FAMILY.

VITIS, Tourn. GRAPE.

V. Labrusca. L. Northern Fox-Grape.

Occurs frequently, according to *Clark*, in the east part of the state, as far northward as southern Pine county, and rarely on the St. Louis river; lake Pepin, *Miss Manning*.

V. æstivalis. Michx. Summer Grape.

Lapham. St. Croix Falls, *Miss Field*; Anoka county, *Juni*; Big Stone lake, *Winchell*; Fergus Falls, *Leonard*. Infrequent. South.

V. cordifolia. Michx.* Winter or Frost Grape.

Frequent in the south half of the state; also in the Red river valley, near Emerson, Manitoba, *Dawson*.

V. riparia. Michx.† (V. cordifolia. Michx., var. riparia. Gray.) Winter or Frost Grape.

Common throughout the state, excepting north of lake Superior.

AMPELOPSIS, Michx. VIRGINIAN CREEPER.

A. quinquefolia, Michx. Virginian Creeper. Five-leaf Ivy. American Ivy. "Woodbine."

Common through the south half of the state and in the Red river valley; probably less frequent northeastward. "A very desirable climber, often cultivated."

RHAMNACEÆ. BUCKTHORN FAMILY.

RHAMNUS, Tourn. BUCKTHORN.

R. alnifolia. L'Her. Alder-leaved Buckthorn.

St. Croix river, *Parry*; Minneapolis, *Winchell*, *Kassube*; beach of lake Superior, *Juni*; lake of the Woods, *Dawson*. Rare southward; common far northward.

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*VITIS CORDIFOLIA. Michx. Tall (or more rarely low), climbing high, trunks not rarely 6 to 9 inches in diameter; leaves middle-sized or small (2½ to 3 or 4 inches in diameter), heart-shaped, mostly entire or very slightly tri-lobed on the edges, with broad, shallow teeth, usually smooth and shining, more on the upper than on the lower side, the young ones sometimes, and very rarely the old ones, with short hair on the ribs below; berries small, in large, mostly loose bunches, black, without a bloom, maturing late in the fall, usually only with a single short and thick seed, marked by a prominent raphe.—— This grows more especially in fertile soil, and is common in river and creek bottoms. *Engelmann*, in *Sixth An. Rep., Insects of Missouri*; also in *Bulletin of the Torrey Botanical Club*.

†VITIS RIPARIA. Michx. Mostly a smaller plant than the last, but with larger (3 to 5 inches in diameter) and more or less incisely 3-lobed, glabrous, shining (or rarely when young, slightly hairy) leaves, the lobes long and pointed, the teeth also more pointed than in V. cordifolia; berries usually larger than in the last, mostly with a bloom, in smaller and often more compact bunches, commonly 1-to 2-seeded; seeds with a less prominent raphe.—— This species prefers thickets or rocky soil on riverbanks; the northern form has fewer and larger berries in a bunch, and is easily distinguished from V. cordifolia. The fruit ripens earlier than the former and is pleasanter. *Engelmann*, in *Insects of Mo.* and in *Bull. Torr. Cl.*

CEANOTHUS, L. NEW JERSEY TEA. RED-ROOT.

C. Americanus, L. New Jersey Tea. Red-root.

Common throughout the state, excepting far northward; especially abundant on sandy tracts in the region of the upper Mississippi river. Though only a small shrub, one to three feet high, its root is a mass of gnarled wood, sometimes six or eight inches in diameter, "a troublesome obstacle in first breaking the soil."

C. ovatus, Desf. (C. ovalis, Bigelow.) Red-root.

Sandy ridges of the St. Croix, "seeming to take the place of the preceding species and an indication of a more barren soil," *Parry*; New Ulm, *Juni*. [Kaministiquia river (very abundant), *Macoun*.] Local.

CELASTRACEÆ. STAFF-TREE FAMILY.

CELASTRUS STAFF-TREE. SHRUBBY BITTER-SWEET.

C. scandens, L. Climbing Bitter-sweet. Wax-work.

Common through the south half of the state, extending north to the sources of the Mississippi, and to Polk county; less frequent north to Emerson, Manitoba, *Scott*.

EUONYMUS, Tourn. SPINDLE-TREE.

E. atropurpureus, Jacq. Burning-Bush. Waahoo.

Frequent southward: extending north to Anoka county, *Juni*, Lake Elizabeth, Kandiyohi county, *Mrs. Terry*, and Clay county in the Red river valley, *Gedge*.

E. Americanus, L., var. **obovatus**, Torr. & Gray. Trailing Strawberry Bush.

Minneapolis, *Winchell*; lake Pepin, *Miss Manning*. Rare.

SAPINDACEÆ. SOAPBERRY FAMILY.

STAPHYLEA, L. BLADDER-NUT.

S. trifolia, L. American Bladder-Nut.

Frequent southward; extending north to Minnehaha falls, *Roberts*, and New Ulm, *Juni*.

ACER, Tourn. MAPLE.

A. Pennsylvanicum, L. Striped Maple. Moose-wood.

Common northeastward, extending south to the upper Mississippi river and to southeastern Pine county; rare and local farther south to lake Pepin, *Miss Manning*.

A. spicatum, Lam. Mountain Maple.

Abundant north of lake Superior and along the international boundary: extending south to Mille Lacs, *Upham*; rare and local farther southward on the Mississippi bluffs at lake Pepin, *Miss Manning*, and in section 22, Richmond, Winona county, *Winchell*.

A. saccharinum, Wang. Sugar Maple. Rock Maple. Hard Maple.

Common, often abundant, throughout the state, excepting near its west side. Not found close to the shore of lake Superior, but common two or three miles from it, 400 feet or more above the lake, attaining a hight of 75 feet, *Clark*. The northern limit of this tree, according to *Bell*, extends from the lower part of the valley of the Kaministiquia river westward, a little to the north of the boundary line, to the lake of the Woods, where it turns south. The Chippewa Indians, who are yet the principal inhabitants of the wooded region north of the Northern Pacific railroad, make considerable maple sugar, their ordinary product in the region of lake Superior, according to *Clark*, being from 100 to 500 pounds for each lodge.

A. saccharinum, Wang., var. **nigrum**, Torr. & Gray. Black Sugar Maple.

Houston county, *Winchell*; upper Mississippi river, *Garrison*. *Mr. J. C. Arthur* reports this variety common at Waterville, Le Sueur county, and believes it to be the prevailing form of the species at least through the south part of the state.

A. dasycarpum, Ehrh. White or Silver Maple. River Maple. Soft Maple.

Common southward, extending north to the upper Mississippi and the White Earth reservation, *Garrison*. More frequently cultivated for shade than the next, each of these species being often called soft maple.

A. rubrum, L. Red Maple. Swamp Maple. Soft Maple.

Common through the east part of the state; extending west to Mud Portage on the Dawson route (north of lake Superior), *Macoun*, the White Earth reservation, *Garrison*, and Redwood Falls, *Pemberton*; abundant in Winona county, *Winchell*. This and the two preceding species, especially the sugar maple, are valuable for furniture and cabinet work, and are fine shade and ornamental trees, for which purpose they are extensively raised from the seed or transplanted from the woods.

NEGUNDO, Mœnch. ASH-LEAVED MAPLE. BOX-ELDER.

N. aceroides, Mœnch. Box-Elder.

Common through the south half of the state, extending thus north to Kanabec, Mille Lacs and Wadena counties; less frequent farther north to the St. Louis river near Fond du Lac, *Winchell*, Kaministiquia river, *Macoun*, and the upper Mississippi river, *Garrison*; also abundant throughout the Red river valley and northwestward, reaching east to the lake of the Woods, *Dawson*. "Destined to be the shade tree of all the prairie cities" of Manitoba (*Macoun*). Along the Minnesota river, it sometimes exceeds three feet in diameter (*Winchell*). Sugar and syrup are made from it at Big Stone lake.

POLYGALACEÆ. MILKWORT FAMILY.

POLYGALA, Tourn. MILKWORT. POLYGALA.

P. sanguinea, L. Purple Milkwort.

Frequent, or common, southward; extending north to the upper Mississippi river, *Garrison*, and Polk county, *Upham*.

P. cruciata, L. Milkwort.

Margins of swampy lakes, St. Croix river, *Parry*; Minneapolis (frequent), *Roberts*; Stearns county, *Mrs. Blaisdell*.

P. verticillata, L. Milkwort.

Frequent, or common, in the south and west portions of the state; extending north to Minneapolis, *Simmons*, New Ulm, *Juni*, and the Red river valley, *Upham*.

P. Senega, L. Seneca Snakeroot.

Common, or frequent, throughout the state. Several tons of this medicinal root are dug and sold yearly by the Chippewa Indians in the region of Mille Lacs, the Crow Wing river and the White Earth reservation, the price which they receive for it, when dried, being from 35 to 50 cents per pound.

P. polygama, Walt. Pink Polygala.

Sandy soil, St. Croix river, *Parry*; lake Pepin, *Miss Manning*; Saint Cloud, *Garrison*; Anoka county and Brainerd, *Upham*; lake of the Woods, *Dawson*.

P. paucifolia, Willd. Fringed Polygala.

Faribault, Rice county, *Miss Beane*. [Kaministiquia river, north of lake Superior, *Macoun*.] Rare.

LEGUMINOSÆ. Pulse Family.

LUPINUS, Tourn. Lupine.

L. perennis, L. Wild Lupine. Perennial Lupine.

Common on light, sandy land from lake Pepin to the sources of the Mississippi river; also, Fergus Falls, *Leonard*. Rarely found with white flowers.

TRIFOLIUM, L. Clover.

T. arvense, L. *Rabbit-foot* or *Stone Clover*.

Saint Cloud, Stearns county, *Campbell*. Rare.

T. pratense, L. *Red Clover*.

Frequently adventive throughout the state.

T. repens, L. White Clover. Shamrock.

Occurring like the last, already very abundant in many districts; also quite certainly indigenous through the north half of the state, *Clark, Upham*.

T. hybridum, L.* *Alsike Clover*.

Adventive, but scarcely established, Saint Cloud (sandy soil, on the grounds of the Normal School), *Campbell*. Rare.

T. procumbens, L. *Yellow Clover*. *Low Hop-Clover*.

Stearns county (both the type and the var. minus, Koch), *Campbell;* Saint Paul, Minneapolis and lake Minnetonka (sparingly adventive), *Roberts;* lake Pepin, *Miss Manning*. Rare.

MELILOTUS, Tourn. Melilot. Sweet Clover. Hart's Clover.

M. officinalis, Willd. *Yellow Melilot*.

Goodhue county, *Sandberg;* Minneapolis (frequent), *Roberts;* Stearns county, *Garrison;* Blue Earth county, *Leiberg*. South.

M. alba, Lam. *White Melilot*.

Throughout the south half of the state. More frequent than the preceding.

MEDICAGO, L. Medick.

M. sativa, L. *Lucerne*. *Alfalfa*.

Escaped from cultivation, Blue Earth county, *Leiberg;* Minneapolis, *Winchell*.

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* *Trifolium hybridum*, L. Almost glabrous; leaflets obovate or oblong; stipules oblong, tips triangular; heads axillary, peduncled, globose; pedicels elongate, at length reflexed; flowers [whitish, rose-tinted] drooping; calyx tube campanulate, gibbous; teeth subulate, nearly equal, unaltered in fruit. *Hooker's Students' Flora of the British Islands*. (See *Botanical Gazette*, vol. vii, pp. 121 and 135.)

HOSACKIA, Dougl. HOSACKIA.

H. Purshiana, Benth.* Hosackia.

Gravelly shore of Swan lake, section 7, Underwood, Redwood county (leaves about ¾ inch long, very short-petioled, of three oblong acute leaflets, the lateral ones oblique in their lower half), *Upham*. Southwest.

PSORALEA, L. PSORALEA.

P. tenuiflora, Pursh. (P. floribunda, Nutt.) Psoralea.

Cottonwood county, *Holzinger*. Southwest

P. argophylla, Pursh. Silvery-leaved Psoralea.

Abundant in all the prairie portion of the state; extending northeast to the upper Mississippi river, *Garrison*. (See note in *American Naturalist*, vol. xvii, p. 414.)

P. esculenta, Pursh. Dakota Turnip. Pomme blanche. Pomme de Prairie. Pomme de Terre.

Common southwestward; extending east to the rising ground east of Red river prairie, *Dawson*, the Roseau river, *Scott*, Morrison county, *Upham*, Minneapolis (rare, found close east of lake Calhoun), *Griswold, Roberts*, and Blue Earth county, *Leiberg*. "*Pomme de Prairie* of the French voyageurs; *Tipsinah* of the Sioux Indians. It occurs over a wide range of country between the Mississippi and the Rocky Mountains, and is a characteristic plant of the Coteau des Prairies. The root, frequently attaining the size of a hen's egg, is of a regular, cylindric, ovoid shape, consisting of a thick, leathery envelope, easily separating when fresh from its smooth internal part. The latter is of a friable texture, except towards the axis, where some ligneous fibres are intermixed. When dry, it acquires a sweetish taste, and is easily pulverized, affording a light, starchy flour, suitable for all the uses of the ordinary article. When growing its aspect is that of a Lupine. It selects a dry, gravelly, but not barren soil." *Parry*.

The Dakota (Sioux) name of the river in western Minnesota, well known as the Pomme de Terre, refers to this plant. Riggs' *Dakota Dictionary*, p. 171.

DALEA, L. DALEA.

D. alopecuroides, Willd. Dalea.

Spirit lake, Iowa, *Geyer*; and doubtless in the adjoining portions of Minnesota. Southwest.

PETALOSTEMON, Michx. PRAIRIE CLOVER.

P. violaceus, Michx. Purple Prairie Clover.

Abundant in all the prairie portion of the state; extending northeast to the upper Mississippi river, *Houghton*.

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[*] HOSACKIA, Dougl. Calyx-teeth nearly equal. Petals free from the stamens, nearly equal; standard often remote from the rest, ovate or roundish; keel curved, obtuse or somewhat acutely beaked. Stamens diadelphous; anthers uniform. Pod linear, compressed or nearly terete, sessile, several-seeded, with partitions between the seeds. Herbaceous or rarely woody, with pinnate 2- to many-foliolate leaves; stipules mostly minute and gland-like; flowers in axillary sessile or pedunculate umbels, yellow, often becoming brownish.

HOSACKIA PURSHIANA, Benth. Annual, usually a foot high or more, and more or less silky-villous: leaflets 1 to 5, ovate to narrowly lanceolate, 2 to 9 lines long; stipules gland-like; flowers small, yellow, on peduncles exceeding the leaves, bracteate with a single leaflet; calyx-teeth linear, much exceeding the tube, about equalling the corolla; pod linear, straight, smooth, an inch long, 5- to 7-seeded. *Watson* in *Botany of Wheeler's Surveys west of the One Hundredth Meridian*

P. candidus, Michx. White Prairie Clover.

Abundant, with same range as the last; excepting that it is less common in the north part of the Red river valley, *Upham*.

P. villosus, Nutt. Silky Prairie Clover.

Common on sandy land, from lake Pepin, *Miss Manning*, Goodhue county, *Sandberg*, and the barrens of the St. Croix river, *Parry*, to Minneapolis, Lac qui Parle, and Polk county, *Upham*.

AMORPHA, L. False Indigo.

A. fruticosa, L. False Indigo. "River Locust."

Common through the south half of the state, in the Red river valley, *Upham*, and to the upper Mississippi river, *Garrison*

A. canescens, Nutt. Lead-plant. "Shoe-strings."

Abundant, with the same range as the last. The common name alludes to its long tough roots, which are troublesome in plowing.

A. microphylla, Pursh.* (A. nana, Nutt.) Dwarf False Indigo.

Common from the Blue Earth river, *Parry*, and Chippewa, Swift and Grant counties, *Roberts*, southwestward; also common, or frequent, throughout the Red river valley, *Upham*.

ROBINIA, L. Locust-tree.

R. Pseudacacia, L. Common Locust-tree. False Acacia.

Adventive, Minneapolis, *Winchell*.

TEPHROSIA, Pers. Hoary Pea.

T. Virginiana, Pers. Goat's Rue. Catgut.

Lapham. Hart, Winona county, *Winchell*; at head of lake Pepin, *Sandberg*, Washington county, *Juni*. South.

ASTRAGALUS, L. Milk-Vetch.

A. caryocarpus, Ker. Ground Plum.

Common, often abundant in all the prairie portion of the state; extending northeast to the upper Mississippi river, *Garrison*. "When the pods, which are nearly solid, have reached the size of hazel-nuts, they prove a valuable addition to the list of early vegetables. Cooked like green peas, they make a pleasing dish, intermediate in taste and flavor between early peas and asparagus." *Arthur*.

A. Plattensis, Nutt., var. **Tennesseensis**, Gray. Ground Plum.

Grant county, *Roberts*; Fergus Falls, *Leonard*. Southwest.

A. Canadensis, L. Milk-Vetch.

Common, or frequent, throughout the state; abundant in the Red river valley, *Upham*.

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*AMORPHA MICROPHYLLA, Pursh. Nearly smooth, dwarf; leaves with very short petioles, obtuse at both ends; spikes short, solitary; calyx nearly naked, pedicellate, teeth all very acuminate; legumes 1-seeded. . . . . . From 1 to 2 feet high; flowers purple and fragrant. A very elegant little shrub. *Pursh's Fl. Amer.*, quoted by *Arthur* (*Contributions to the Flora of Iowa, No. V.*), who adds: "This compact little shrub is abundant on the dry prairies of northwestern Iowa. It flowers in May, and not in July and August as stated by Pursh. The leaflets are oblong, conspicuously punctate, and in 10—20 pairs."

A. hypoglottis, L.† Milk-Vetch.

Plains near Pembina, *Douglas*, *Chickering*, *Havard*. Red river prairie. *Dawson*. West.

A. gracilis, Nutt.‡ Milk-Vetch.

Minnesota, *Watson*. Southwest.

A. Cooperi, Gray. Cooper's Milk-Vetch.

Upper Mississippi river, *Garrison*; lake Pepin, *Miss Manning*. Rare.

A. flexuosus, Dougl.§ Milk-Vetch.

Red river prairie, *Douglas*, *Macoun*, *Dawson*, *Scott*. West.

OXYTROPIS, DC. OXYTROPIS.

O. Lamberti, Pursh. Oxytropis.

Frequent or common, westward; extending east to Worthington (rare) *Foote*, Cottonwood county, *Holzinger*. Glenwood (common, with flowers bright rose-purple, changing later to blue), *Upham*. Douglas county, *Mrs. Terry*. Fergus Falls, *Leonard*, and the Red river valley, *Douglas*, *Macoun*.

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[*] ASTRAGALUS ADSURGENS, Pall. Perennial, cinereous with minute appressed pubescence or glabrate; stems rather stout, 4 to 18 inches high, ascending or decumbent; stipules scarious, mostly united at base; leaflets 10 pairs, 6 to 9 lines long, narrowly or linear-oblong; spike dense, at length oblong or cylindrical; flowers purplish, medium sized, ascending; calyx-tube rather long-campanulate, twice exceeding the setaceous teeth, subvillous with light or dark hairs; pod coriaceous, pubescent, sessile, ascending, ovate-oblong (4 to 5 lines in length), straight, usually triangular-compressed, with a dorsal sulcus, and 2-celled by the intruded dorsal suture, many-ovuled. *Watson's Rep. in King's Expl. of the Fortieth Parallel*, following *Gray's Revis., Proc. Amer. Acad.*, vol. vi.

[†] ASTRAGALUS HYPOGLOTTIS, L. Perennial, with a rather loose pubescence, or nearly glabrous; stems 6 inches to 2 feet long, slender, diffusely procumbent or ascending; stipules subfoliaceous and more or less sheathing; leaflets 7 to 10 pairs, oblong, obtuse or retuse; heads rather many-flowered; corolla violet, ½ inch long; legume coriaceous, ovate and triangular, silky-villous, very shortly stipitate, 2-celled by the intruded dorsal suture, and but 6- to 8-seeded. From southern Colorado northward along the Rocky Mountains and Red River Valley to the Arctic Circle and Alaska. June to September. *Watson's Rep. in King's Expl. of the Fortieth Parallel*, following *Gray's Revision*.

[‡] ASTRAGALUS GRACILIS, Nutt. Perennial, somewhat appressed pubescent, slender, erect or ascending, a foot high or more: leaflets three to five pairs, narrowly linear, half an inch long or less: flowers very small, white or purplish, in an elongated open long-peduncled spike: calyx-teeth very short: pods coriaceous, sessile, pubescent and rugose, 2 or 3 lines long, ovate-oblong and obcompressed, 1-celled, concave on the back, and the ventral suture prominent. *Watson* in *Botany of Wheeler's Surveys west of the One Hundredth Meridian*.

[§] ASTRAGALUS FLEXUOSUS, Dougl. Ashy-puberulent; stems ascending, 1 foot high, flexuose; leaflets oblong or cuneate-linear, obtuse or retuse; peduncles exceeding the leaves; racemes mostly elongated, loose; flowers 4 lines long, white or purplish; calyx hoary-pubescent, teeth three times shorter than the tube, pod cylindric, 8 to 11 lines long, 2 lines broad, puberulent, thinly coriaceous, straight or sub-incurved; stipe very short, but evident. *Gray's Revision of Astrag., Proc. Amer. Acad.*, vol. vi.

O. splendens, Dougl.* Silvery Oxytropis.

"A most elegant plant, with its crowded, silvery, silky-villous foliage and spikes, and deep blue corollas. It was gathered on the Chippewa river" [in Minnesota]. *Gray* in *Pacific Railroad Report.* Glenwood, Pope county, *Upham;* Pembina, *Douglas, Havard.* West.

GLYCYRRHIZA, Tourn. LICORICE.

G. lepidota, Pursh. Wild Licorice.

Abundant westward, from St. Vincent to Iowa; extending east to lake Pepin, *Miss Manning,* Freeborn county and Minneapolis, *Upham,* the St. Croix river, *Parry,* Stearns county, *Campbell,* and the lake of the Woods at the mouth of Rainy river, *Macoun;* but not reported in the region of the upper Mississippi river and farther northeast.

HEDYSARUM, Tourn. HEDYSARUM.

H. boreale, Nutt. HEDYSARUM.

Lapham. [North shore of lake Superior, *Agassiz.*] North.

DESMODIUM, DC. TICK-TREFOIL.

D. nudiflorum, DC. Tick-Trefoil.

St. Croix river, *Parry;* Anoka county, also New Ulm, *Juni;* Blue Earth county, *Gedge;* Redwood Falls, *Pemberton.* Infrequent. South.

D. acuminatum, DC. Tick-Trefoil.

Common southward; extending north to the upper Mississippi river, *Garrison;* Fergus Falls, *Leonard.*

D. rotundifolium, DC. Round-leaved Tick-Trefoil. Trailing Tick-Trefoil.

Upper Mississippi river, *Garrison.* Infrequent. South.

D. canescens, DC. Tick-Trefoil.

Otter Tail county, *Upham;* Nicollet county, *Aiton;* Blue Earth county, *Leiberg;* lake Pepin, *Miss Manning.* Infrequent. South.

D. cuspidatum, Hook. Tick-Trefoil.

Lapham. Upper Mississippi river, *Garrison.* Infrequent. South.

D. Dillenii, Darlingt. Tick-Trefoil.

Stearns county, *Garrison;* Douglas county, *Mrs Terry;* Minneapolis, *Kassube;* Steele county (common), *Upham.* South.

D. paniculatum, DC. Tick-Trefoil.

Upper Mississippi river, *Garrison;* Winona county, *Holzinger;* Hesper, Iowa, *Mrs. Carter.* Infrequent. South.

D. Canadense, DC. Tick-Trefoil.

Common through the south half of the state, and perhaps northward; found at the lake of the Woods, *Dawson, Burgess,* and extending into Manitoba to the north end of lake Winnipeg, *Hooker.*

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*OXYTROPIS SPLENDENS, Dougl. Acaulescent, silvery, silky-villous throughout, 6 to 12 inches high; leaflets somewhat verticillate, 3 to 6 together, very numerous, lanceolate, very acute, usually 5 to 10 lines long; flowers in an oblong spike, erect, spreading, usually deep blue; peduncles exceeding the leaves; flowers not much surpassing the calyx; pod ovate, erect. *Porter and Coulter's Flora of Colorado.*

LESPEDEZA, Michx. BUSH-CLOVER.

L. repens, Barton. (Including L. procumbens, Michx.) Bush-Clover
Upham. Rare. South.

L. violacea, Pers. Bush-Clover.
Blue Earth county, *Leiberg*; Brown county, *Juni.* Infrequent. South.

[L. reticulata, Pers. (L. violacea, Pers., var. sessiliflora, Don) probably occurs in the south part of the state.

L. reticulata, Pers., var. **angustifolia,** Maxim. (L. violacea, Pers., var. angustifolia, Torr. & Gray.) Bush-Clover.
Cottonwood county, *Holzinger.* Infrequent. South.

L. hirta. Ell. Bush-Clover.
Lake Pepin, *Miss Manning*; Cottonwood county, *Holzinger.* Infrequent. South.

L. capitata, Michx. Bush-Clover.
Common, or frequent, through the south half of the state; extending north at least to Cass county, *Upham.*

L. leptostachya. Engelm.[*] Bush-Clover.
Southeastern Minnesota, *T. J. Hale*; Emmet county, Iowa (common), *Crotty*; Rock county (common), *Leiberg.* South.

VICIA, Tourn. VETCH. TARE.

V. sativa, L. *Vetch.*
Lake Pepin, *Miss Manning.* Rare.

V. Cracca, L. Blue Vetch.
Minneapolis, and Carlton county, *Roberts*; White Bear, Ramsey county, *Miss Field.* Rare. South.

V. Caroliniana, Walt. Pale Vetch. Carolina Vetch.
Frequent through the south half of the state; extending north to the upper Mississippi river, *Garrison,* and Fergus Falls, *Leonard.*

V. Americana, Muhl. Purple Vetch. American Vetch.
Common throughout the state.

LATHYRUS, L. VETCHLING. EVERLASTING PEA.

L. maritimus, Bigelow. Beach Pea.
Common on beaches of gravel and sand, north shore of lake Superior, *Juni, Roberts*; lake of the Woods, *Dawson.*

L. venosus, Muhl. Vetchling.
Common through the south half of the state, and in the Red river valley; extending northeast to the upper Mississippi river, *Garrison,* and Kaministiquia river, *Macoun.*

L. ochroleucus, Hook. Pale Vetchling.
Common, often abundant, throughout the state.

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[*] LESPEDEZA LEPTOSTACHYA, Engelm. Clothed with appressed, silky pubescence; leaves linear; petiole longer than the terminal petiolule; spikes paniculate, slender, somewhat loosely flowered, rather longer than the peduncle; legume equal to or slightly longer than the calyx. . . . . . Has passed for L. angustifolia, from which its slender spikes and paniculate habit at once distinguish it. *Gray, Proc. Amer. Acad. of Arts and Sciences,* vol. xii.

L. paluster, L. Marsh Vetchling.

Common throughout the state.

L. paluster, L., var. **myrtifolius,** Gray. Marsh Vetchling.

Blue Earth county, *Leiberg;* Stearns county, *Campbell;* Fergus Falls, *Leonard.*

APIOS, Boerhaave. GROUND-NUT. WILD BEAN.

A. tuberosa, Mœnch. Ground-nut. Dakota Potato. Pomme de Terre.

Common, or frequent, through the south half of the state; extending north to the upper Mississippi river. "*Pomme de Terre* of the French voyageurs; *Mdo*, or wild potato, of the Sioux Indians." *Parry.*

PHASEOLUS, L. KIDNEY BEAN.

P. perennis, Walt. Wild Bean.

Saint Paul, *Kelley;* St. Croix Falls, *Miss Field;* upper Mississippi river, *Garrison;* Pembina, *Havard.*

P. diversifolius, Pers. Wild Bean.

Minneapolis, *Twining;* Blue Earth county, *Leiberg;* New Ulm, *Juni;* Emmet county, Iowa (rare), *Cratty.* Southeast.

P. pauciflorus, Benth. Wild Bean.

Frequent through the south half of the state; extending north to the head-waters of the Mississippi river, *Garrison.*

AMPHICARPÆA, Ell. HOG PEA-NUT.

A. monoica, Ell. Hog Pea-nut.

Common throughout the state, excepting perhaps far northward.

BAPTISIA, Vent. FALSE INDIGO.

B. tinctoria, R. Br. Wild Indigo.

Anoka county, and White Bear, Ramsey county, *Juni;* near Saint Paul, *Mrs. Terry;* lake Pepin, *Miss Manning.* Infrequent. Southeast.

B. leucantha, Torr. & Gray. White False Indigo.

Frequent through the south half of the state; extending north to the upper Mississippi river, *Garrison,* and Fergus Falls, *Leonard.*

B. leucophæa, Nutt. Yellowish Wild Indigo.

Common in the most southern counties across the state; extending north to lake Pepin, *Miss Manning,* Rice county, *Upham,* and Minneapolis, *Kassube.*

CERCIS, L. RED-BUD. JUDAS-TREE.

C. Canadensis, L. Red-bud. Judas-tree.

Southern Minnesota, *Sargent's Catalogue of Forest Trees, Tenth Census of U. S.* If found in this state, it must be rare or local, in the most southeastern counties.

CASSIA, L. Senna.

C. Chamæcrista, L. Partridge Pea. Sensitive Pea.

Frequent, or common, throughout the southern third of the state; less frequent rather north to the upper Mississippi river, *Houghton.*

GYMNOCLADUS, Lam. KENTUCKY COFFEE-TREE.

G. Canadensis, Lam. Kentucky Coffee-tree.

Houston county, near Dakota, Winona county, and Jordan, Scott county, *Winchell;* Lake City, *Miss Manning;* Nicollet county (forming groves in the woods opposite to Mankato; attaining a diameter of six inches; wood very hard, straight-grained, valuable), *Leiberg;* New Ulm, *Juni;* Sleepy Eye, Brown county, *Upham*. Infrequent. South.

DESMANTHUS, Willd. DESMANTHUS.

D. brachylobus, Benth. Desmanthus.

Swan lakes, northwestern Redwood county, *Upham;* Spirit lake, Iowa, *Geyer*. South.

ROSACEÆ. ROSE FAMILY.

PRUNUS, Tourn. PLUM, CHERRY, ETC.

P. Americana, Marshall. Wild Plum.

Common, often abundant, throughout the state. Usually from 10 to 20 feet high; but north of lake Superior seldom exceeding 12 feet in hight, and often fruiting at 3 or 4 feet, *Clark*. Fruit valuable, pleasant-flavored, rarely bitter, mostly purple, but not infrequently varying from that color to yellow.

P. pumila, L. Dwarf Cherry. Sand Cherry.

Common on sandy land through the north half of the state, and south to Minneapolis; local and rare farther south, as at Castle Rock and in Goodhue county, *Sandberg*, lake Pepin, *Miss Manning*, and section 33, Hart, Winona county, *Winchell*.

P. Pennsylvanica, L. Wild Red Cherry. Bird Cherry.

Common throughout the state, excepting southwestward, where it occurs rarely. Usually 15 to 30 feet high; but north of lake Superior its ordinary hight is about 12 feet, with a diameter of 2½ inches, *Clark*.

P. Virginiana, L. Choke-Cherry.

Common throughout the state.

P. serotina, Ehrh. Wild Black Cherry.

Common throughout the state, excepting far northward, where it is absent or rare. *Macoun* reports it as far west as the Kaministiquia river, lake Superior.

NEILLIA, Don. NINE-BARK.

N. opulifolia, Benth. and Hook. (Spiræa opulifolia, L.) Nine-Bark.

Frequent throughout most of the state, but rare southward and westward; abundant north of lake Superior, especially along the shore, "clinging to bare rocks, often within the sweep of the waves," *Juni, Roberts;* Rainy river and lake of the Woods, *Macoun*.

SPIRÆA, MEADOW-SWEET. SPIRÆA.

S. salicifolia, L. Common Meadow-Sweet. Willow-leaved Spiræa. Queen of the Meadow.

Common throughout the state.

S. tomentosa, L. Hardhack. Steeple-Bush.

Frequent, in some places plentiful, in Hennepin, Anoka, Chisago, Isanti and Kanabec counties, *Roberts, Juni, Upham*. East. [It is also found at lake Winnipeg,

AGRIMONIA, Tourn. AGRIMONY.

A. Eupatoria, L. Common Agrimony.

Frequent, often common, throughout the state.

GEUM, L. AVENS. GEUM.

G. album, Gmelin. White Avens.

Frequent, or common, throughout the state; extending northward to the north shore of lake Superior, *Juni*, and Pembina, *Havard*.

G. Virginianum, L. Virginian Avens.

Minnesota river, *Parry;* Blue Earth county, *Leiberg;* Goodhue county, *Sandberg;* Hesper, Iowa, *Mrs. Carter*. Infrequent. South.

G. macrophyllum, Willd. Large-leaved Avens.

Abundant north of lake Superior, *Roberts;* extending south to Sherburne county, *Upham*, Anoka county and New Ulm, *Juni*, and lake Minnetonka, *Roberts*.

G. strictum, Ait. Strict Avens.

Throughout the state; common northward, frequent southward.

G. rivale, L. Water Avens. Purple Avens.

Common, or frequent, through the north half of the state; extending south to lake Pepin, *Miss Manning*, Northfield, Rice county, *Chaney*, and Nicollet county, *Aiton*.

G. triflorum, Pursh. Three-flowered Avens.

This species, "attractive by reason of its long, plumose styles, and dissected, fern-like leaves," rare in states farther east, is common, or frequent, on dry somewhat sandy land throughout Minnesota, excepting northeastward, in which direction it extends at least to the head of lake St. Croix, Brainerd, and the upper Mississippi river.

WALDSTEINIA, Willd. DRY or BARREN STRAWBERRY.

W. fragarioides, Tratt. Barren Strawberry.

Stearns county, *Garrison;* St. Croix Falls and Stillwater, *Miss Field*. Infrequent. East.

POTENTILLA, L. CINQUE-FOIL. FIVE-FINGER. POTENTILLA.

P. Norvegica, L. Cinque-foil.

Common throughout the state.

P. supina, L. (P. paradoxa, Nutt.) Cinque-foil.

Lake Pepin, *Miss Manning;* sandy shores of lake Minnetonka, *Roberts*, *Herrick;* Anoka county and New Ulm, *Juni;* Martin county (rare), *Cratty;* Stearns county, *Garrison*; Grant county, *Roberts*. [Devil's lake, Dakota, *Geyer*, and northwestward.] South and west.

P. Canadensis, L. Common Cinque-foil or Five-Finger.

Common, or frequent, throughout the state, excepting perhaps far northward.

P. Canadensis, L., var. **simplex**, Torr. and Gray. Cinque-foil. Five-Finger.

Lake Pepin, *Miss Manning;* New Ulm, *Juni;* Emmet county, Iowa (rare), *Cratty;* Minneapolis (common), *Roberts;* Sherburne county (common), *Upham*. [North of lake Superior, *Agassiz*.]

P. argentea, L. Silvery Cinque-foil or Five-Finger.

Winona county, *Holzinger;* Saint Paul, *Miss Cathcart:* Minneapolis, *Herrick, Upham:* Washington county, *Leonard:* St. Croix Falls, *Miss Field:* Anoka county, *Juni;* near Green lake, Kandiyohi county, *Mrs. Terry.* [Sheyenne river, Dakota, *Geyer.*] Infrequent.

P. Pennsylvanica, L., var. **strigosa,** Pursh.* Cinque-foil. Potentilla.

Granite knolls beside the Minnesota river in the west part of Nicollet county, *Parry;* Redwood Falls, *Pemberton:* Worthington (common), *Foote;* Luverne, *Leiberg;* Pipestone quarry, *Mrs. Bennett;* Fergus Falls, *Leonard.* [Pembina mountain, Dakota, *Havard.* "The common form in the prairie region" of Manitoba, *Macoun.*] West.

P. Pennsylvanica, L., var. **bipinnatifida,** Torr. & Gray.** Cinque-foil.

Pipestone county, *Mrs. Bennett:* plains of the Red river, *Douglas, Macoun.* West.

P. Hippiana, Lehm. † Cinque-foil. Potentilla.

Plains of the Red river, *Drummond, Macoun.* West.

P. effusa, Dougl.‡ Cinque-foil. Potentilla.

Higher parts of the Red river valley, plentiful, *Douglas, Macoun.* West.

P. arguta, Pursh. Cinque-foil. Potentilla.

Common, often abundant, throughout the state.

P. Anserina, L. Silver-Weed.

Common, or frequent, throughout the north half of the state; extending south at least to Minneapolis and Murray county, *Upham.*

P. fruticosa, L. Shrubby Cinque-foil.

Abundant north of lake Superior, especially along its rocky shore, *Juni, Roberts;* also found near the Tamarack river in T. 158, R. 46, Marshall county, *Upham,* and at the eastern border of the Red river prairie near the international boundary, *Dawson, Scott.* (Not yet reported, but doubtless occurring rarely, in the south half of the state; found at Decorah, Iowa, *Arthur.*) North.

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* POTENTILLA PENNSYLVANICA, L., var. STRIGOSA, Pursh. Low, 6 to 15 inches high; stems erect, leafy, rather stout; leaves mostly tomentose on both surfaces, paler beneath, deeply pectinate-divided or pinnatifid, segments linear, entire, with revolute margins; stipules laciniate. *Porter and Coulter's Flora of Colorado,* following *Watson's Revis., Proc. Amer. Acad.,* vol. viii.

** POTENTILLA PENNSYLVANICA, L., var. BIPINNATIFIDA, Torr. & Gray. Leaflets crowded (3 to 5) and often almost palmate, deeply pinnatifid (silky-pubescent but not canescent above); the segments linear, elongated, mostly spreading. *Torrey and Gray's Flora of N. A.*

† P. HIPPIANA, Lehm. Densely white-tomentose and silky throughout; the upper surface of the leaves a little darker; stems ascending, 1 to 1½ feet high, slender, branching above into a diffuse cyme, stipules usually entire; leaves pinnate, occasionally digitate; leaflets 5 to 11, cuneate-oblong, 1 to 2 inches long, obtuse, incisely toothed, at least towards the apex, margins not revolute; pedicels slender; bractlets narrow; petals 2½ to 3½ lines long, exceeding the calyx; styles filiform, not glandular at base, terminal; carpels 10 to 30. *Porter and Coulter's Flora of Colorado,* following *Watson's Revision.*

‡ P. EFFUSA, Dougl. Canescently tomentose with scattered villous hairs; stems ascending, diffusely branched above, 4 to 12 inches high; stipules lanceolate, entire or incised; leaflets 5 to 11, interruptedly pinnate, the alternate ones often smaller, cuneate-oblong, coarsely incised-serrate or dentate, the smaller leaflets 3- to 5-toothed; pedicels slender; sepals and the much smaller bractlets acuminate, 2 to 3 lines long, equaling or exceeding the obcordate petals; carpels 10. *Porter and Coulter's Flora of Colorado,* following *Watson's Revision.*

P. tridentata, Sol. Three-toothed Cinque-foil.

Frequent through the north part of the state ; common along the rocky north shore of lake Superior and on Minnesota Point, at the last named locality growing in the dry loose sand, *Roberts, Juni* ; infrequent, or rare, southward to Stearns county, *Mrs. Blaisdell*, White Bear, Ramsey county, *Miss Field*, Lake City, *Mrs. Ray*, and Hesper, Iowa, *Mrs. Carter*.

P. palustris, Scop. Marsh Five-Finger.

Throughout the state ; common northward, frequent southward.

FRAGARIA, Tourn. STRAWBERRY.

F. Virginiana, Duchesne. Wild Strawberry.

Common throughout the state.

F. Virginiana, Duchesne, var. **Illinoensis,** Gray. Wild Strawberry.

Dakota county, *Winchell;* Anoka and Sherburne counties (common), *Upham;* abundant in Martin county (and in Emmet county, Iowa), *Cratty*.

F. vesca, L. Wild Strawberry. Wood Strawberry.

Mostly in woods ; common through the north half of the state and southwestward, frequent southeastward.

RUBUS, Tourn. BRAMBLE.

R. Dalibarda, L. (Dalibarda repens, L.) Dalibarda.

Lapham. Green Lake, Kandiyohi county, *Mrs. Terry*. Rare. East.

[R. odoratus L., which occurs in northern Michigan and Wisconsin, probably does not extend into Minnesota.]

R. Nutkanus, Mocino. White Flowering-Raspberry.

Abundant north of lake Superor, *Juni, Roberts;* and extending to the sources of the Mississippi, *Houghton*. "Its showy white blossoms are about as large as those of the wild rose. The fruit is large and looks tempting but has a peculiar acid flavor, which makes it inferior to that of Rubus strigosus." *Juni*. North.

R. arcticus, L.* Arctic Raspberry.

Peat bog, "northwest angle" of the lake of the Woods, *Macoun*. North.

R. triflorus, Richardson. Dwarf Raspberry.

Common, or frequent, through the north half of the state ; extending south to New Ulm, *Juni*, Blue Earth county, *Leiberg*, and Hesper, Iowa, *Mrs. Carter*.

R. strigosus, Michx. Wild Red Raspberry.

Common throughout the state, excepting southwestward, where it occurs less frequently ; very abundant northward.

R. occidentalis, L. Black Raspberry. Black-cap Raspberry. Thimble-berry.

Common through the south half of the state, and north to the White Earth reservation, the upper Mississippi river, and Pine county ; rare or wanting northeastward. A variety bearing cream-colored fruit occurs on the bluffs of the Mississippi at Winona, *Winchell*.

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*RUBUS ARCTICUS, L. Stem low, herbaceous, sometimes diœcious, unarmed, somewhat pubescent, mostly erect, 1- to 2-flowered, leaves trifoliolate; leaflets rhombic-ovate or obovate, coarsely and often doubly serrate, petiolulate ; stipules ovate ; sepals lanceolate, acute, often shorter than the obovate entire or emarginate (reddish) petals. *Torrey and Gray's Flora of N. A.*

Frequent, occasionally plentiful, throughout most of the state; but rare or wanting in some districts, especially southwestward and far northwest. **Local.**

R. villosus, Ait., var. **frondosus**, Torr. High Blackberry.

Between lake Superior and lake Winnipeg. *Richardson* (*Macoun*).

R. Canadensis, L. Low Blackberry. Dewberry.

Frequent, or common, through the east part of the state, extending west to Blue Earth county, *Leiberg*, Fergus Falls, *Leonard*, and the White Earth reservation, *Garrison*; north of lake Superior, *Agassiz*, *Macoun*.

R. hispidus, L. Running Swamp-Blackberry.

Similar in range with the last. Minneapolis, *Griswold*; Sherburne county (common), *Upham*; Fergus Falls, *Leonard*; upper Mississippi river, *Garrison*.

ROSA, Tourn. ROSE.

R. Carolina, L. Swamp Rose.

Houston county, *Winchell*; Blue Earth county, *Leiberg*; Northfield, *Chaney*; Morrison county, *Miss Babbitt*. Infrequent.

R. parviflora, Ehrh. (R. lucida, in *Manual*.) Dwarf Wild-Rose.

North of lake Superior (common), *Roberts*; White Earth reservation, *Garrison*; Kanabec county (common), *Upham*; St. Croix Falls, *Miss Field*; Hennepin and Fillmore counties, *Winchell*; Rice county, *Sperry*; Goodhue county, *Blake*, *Sandberg*.

R. blanda, Ait., var. **pubescens**, Crépin.* Early Wild Rose.

Common, often abundant, in all parts of the state; the only species of rose (but occurring in two varieties) in our prairie region, there varying in hight from about one foot, or sometimes two feet on the prairie, to three or four feet in groves and thickets, or even six feet, according to *Roberts*, in Grant county.

R. blanda, Ait., var. **setigera**, Crépin.† Early Wild Rose.

Specimens collected in Minneapolis are referred by *Watson* to this variety, which probably occurs, less frequently than the preceding, throughout the state, being most common northward.

CRATÆGUS, L. HAWTHORN. WHITE THORN.

C. coccinea, L. Scarlet-fruited Thorn.

Frequent, occasionally common, through most of the state; extending "north to the international boundary, but not much beyond it," *Bell*. [Emerson and Winnipeg, Manitoba, *Dawson*, *Macoun*.]

C. tomentosa, L. Black Thorn. Pear Thorn.

Common, or frequent, throughout the state.

C. tomentosa, L., var. **pyrifolia**, Gray. Black or Pear Thorn.

Olmsted county, *Winchell*; American portage, near the international boundary west of lake Superior, *Macoun*.

C. tomentosa, L., var. **punctata**, Gray. Black or Pear Thorn.

Martin county, *Cratty*; Olmsted county and lake Minnetonka, *Winchell*; Minneapolis, *Upham*; Pembina, *Chickering*. Perhaps the typical species is less common than these varieties.

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*ROSA BLANDA, Ait., var. PUBESCENS, Crepin. Leaflets more or less pubescent on the under side; upper part of the stems, as well as the branches and flowering branchlets, unarmed or nearly so. *Crepin's Monograph*.

†ROSA BLANDA, Ait., var. SETIGERA, Crepin. Leaflets glabrous or pubescent on the under side; stem not ordinarily more than a foot high, entirely covered with setaceous prickles. *Crepin's Monograph*.

C. subvillosa, Schrader. (C. tomentosa, L., var. mollis, Gray.) Downy Thorn.

Blue Earth county (common, becoming a tree twenty feet high). *Upham;* New Ulm, *Juni;* Emmet county, Iowa (rare), *Cratty;* Pipestone quarry, *Mrs. Bennett.* [North of lake Superior, *Bell, Macoun.*]

C. Crus-galli, L. Cockspur Thorn.

Winona, Fillmore, Mower, Freeborn and Scott counties, and the Big Woods, *Winchell;* lake Pepin, *Miss Manning;* Dodge county, *Harrington;* Rice county, *Sperry;* Hennepin county, *Simmons;* Fish-hook lake, Cass county, and the White Earth reservation, *Garrison.* ["In Manitoba a thorn which appears to be identical with this species is abundant." *Bell.*]

PIRUS (Pyrus), L. PEAR. APPLE.

P. coronaria, L. American Crab-Apple.

Common in the southeast part of the state; extending west to the Big Woods, and north to Ramsey and Hennepin counties, *Winchell,* and to Crow lake in southwestern Stearns county, *Upham.* The fruit, though bitterish, is frequently used for sauce.

P. arbutifolia, L. Choke-berry.

Frequent from Olmsted county, *Harrington,* and Faribault, *Miss Beane,* to Minneapolis, *Roberts,* Anoka county, *Juni,* and the St. Croix river, *Parry.* East.

P. arbutifolia, L., var. **melanocarpa,** Hook. Choke-berry.

Pine county (common), *Upham;* north of lake Superior, extending west to Sturgeon lake, Dawson route, *Macoun.* East.

P. Americana, DC. American Mountain-Ash.

Common through the north part of the state; extending south to northern Pine county, and to Mille Lacs. "A common tree north of lake Superior, attaining considerable size. *Professor Winchell* collected specimens where the trunk was at least 12 inches in diameter, and perfectly sound. Others, though unsound, were 15 and 16 inches." *Roberts.*

P. sambucifolia, Cham. & Schlecht. Elder-leaved Mountain Ash.

Common northward; extending south to Itasca lake, *Garrison,* and T. 137, R. 33, Wadena county, *Upham;* and rare farther south, as on the bluffs of the Mississippi at Winona, *Winchell.*

AMELANCHIER, Medic. JUNE-BERRY.

A. Canadensis, Torr. & Gray. (Including the var. Botryapium, Torr. & Gray.) Shad-bush. Service-berry.

Common throughout the state. (Usually from 10 to 30 feet high, but northeastward only attaining a hight of 10 feet and diameter of 2½ inches; used by the Indians for snow-shoe frames. *Clark.*)

A. Canadensis, Torr. & Gray, var. **oblongifolia,** Torr. & Gray. Service-berry.

Common, or frequent, throughout the state.

A. Canadensis, Torr. & Gray, var. **oligocarpa,** Torr. & Gray. Service-berry.

Loon portage, Dawson route (near the international boundary). *Macoun.* North.

A. alnifolia, Nutt. (A. Canadensis, Torr. & Gray, var. alnifolia, Torr. & Gray.) Western June-berry.

Pembina, *Chickering;* White Earth reservation, *Garrison;* Hennepin county, *Roberts;* Faribault, *Miss Beane;* Lake City, *Mrs. Ray.* Frequent.

SAXIFRAGACEÆ. SAXIFRAGE FAMILY.

RIBES, L. CURRANT. GOOSEBERRY.

R. Cynosbati, L. Prickly Wild Gooseberry.

Common, often abundant, throughout the state. Much used, (as also the following smooth species,) before fully ripening, for sauce.

[Of R. setosum, Lindl., Prof. Gray writes: "I suspect that this species inhabits the northwestern shore of lake Superior. Botanists visiting that district should look for a species with pure white flowers, a half inch or less in length, with cylindrical tube, and stamens decidedly shorter than the lobes. . . . It takes its name from the slender scattered prickles on the branches; but these are sometimes wanting, this being an inconstant character in all the species. The young berries are either perfectly smooth and naked, or beset with a few bristly prickles. This is the R. oxyacanthoides of Hooker's Flora, but certainly not of Linnæus. It belongs to the Saskatchewan region, extending into Montana and Wyoming." *American Naturalist*, vol. x, pp. 271-2.

R. oxyacanthoides, L. (R. hirtellum, Michx.) Smooth Wild Gooseberry.

Common throughout the state, excepting perhaps southward, in which direction it extends at least to Goodhue county, *Sandberg*, Faribault, *Miss Beane*, and Fergus Falls, *Leonard*.

R. rotundifolium, Michx. Smooth Wild Gooseberry.

Notes by observers using Gray's *Manual* give this as common through the south half of the state, and less frequent northward to the St. Louis river, *Mrs. Herrick*, and Grand Marais, north of lake Superior, *Roberts*. Further investigation is needed, however, to decide whether R. rotundifolium occurs in Minnesota. Just as this is being printed, I learn from Mr. Arthur that Prof. Gray decides specimens of the common smooth wild gooseberry in Iowa (before regarded as R. rotundifolium) to be R. gracile, Michx. "R. rotundifolium Michx. is a species of the Alleghany Mountains, ranging northward and eastward into New York and the western borders of Massachusetts." (*Gray* in *American Naturalist*, vol. x.) Probably most, or perhaps all, of the supposed observations of this species in Minnesota belong instead to the next.

R. gracile, Michx. (R. Missouriense, Nutt.)* Missouri Gooseberry.

Lapham. See remarks under the preceding species.

R. lacustre, Poir. Swamp Wild Gooseberry.

Lapham. North of lake Superior, *Juni*, *Roberts*. North.

R. prostratum, L'Her. Fetid Currant. Skunk Currant.

Common north of lake Superior, *Juni*, *Roberts*; St. Louis river, *Mrs. Herrick*; upper Mississippi river, *Garrison*. North.

R. floridum, L'Her. Wild Black Currant.

Common, or frequent, throughout the state.

R. rubrum, L. Red Currant.

Frequent through the north half of the state; extending south to southeastern Pike county and Benton county, *Upham*, Fish-hook lake, Cass county, *Garrison*, and Fergus Falls, *Leonard*.

R. aureum, Pursh. *Buffalo Currant. Missouri Currant.*

Escaped from gardens: Mankato, *Leiberg;* Minneapolis, *Kassube*.

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*RIBES GRACILE, Michx. Flowers 1 to 4 on the slender peduncle, white or whitish, narrow, with calyx-lobes longer than the tube and shorter than the half-inch stamens; filaments almost capillary, generally connivent or closely parallel, and soon conspicuously longer than the oblong-linear calyx-lobes; flower with barely a slight tinge of green; berry smooth, large, purple, prized in cultivation under the name of Missouri Gooseberry. It ranges from Tennessee and Illinois to the northern borders of Texas, and northwestward into the Rocky Mountains. *Gray* in *American Naturalist*, vol. x.

PARNASSIA, Tourn. GRASS OF PARNASSUS.

P. parviflora, DC. Grass of Parnassus.

North shore of lake Superior, *Macoun.*

P. palustris, L. Grass of Parnassus.

North shore of lake Superior, *Juni;* Fort Francis, Rainy river, *Macoun;* common in the Red river valley, along the Pembina and Fort Garry trails, from Tamarack river northward into Manitoba, *Upham;* extending southward to Stearns county, *Garrison, Mrs. Blaisdell.*

P. Caroliniana, Michx. Grass of Parnassus.

Common through the south half of the state, and north to the upper Mississippi river, *Garrison,* and Polk county, *Upham;* also, lake of the Woods, *Burgess* (*Macoun*), and between the lake of the Woods and Red river, "probably about the northwestern limit of the species," *Dawson;* Pembina, *Havard.*

SAXIFRAGA, L. SAXIFRAGE.

S. tricuspidata, Retz. Saxifrage.

North shore of lake Superior, doubtless in Minnesota ; Isle Royale, *Whitney.*

S. Aizoon, Jacq. Saxifrage.

North shore of lake Superior, *Macoun, Ellis;* Isle Royale, *Whitney.*

S. Virginiensis, Michx. Early Saxifrage.

Lapham. Hastings, Dakota county, *Mrs. Ray.* Rare.

S. Pennsylvanica, L. Swamp Saxifrage.

Common, or frequent, throughout the state.

SULLIVANTIA, Torr. & Gray. SULLIVANTIA.

S. Ohionis, Torr. & Gray. Sullivantia.

Rock bluffs of the Mississippi river, near Dakota, Winona county, *Winchell.* Rare.

HEUCHERA, L. ALUM-ROOT.

H. Americana, L. Common Alum-root.

St. Louis river, *Houghton;* Cass lake, *Schoolcraft;* Stearns county, *Campbell;* Stillwater, *Miss Field;* Goodhue county, *Sandberg;* lake Pepin, *Miss Manning;* Winona county, *Holzinger.* Infrequent.

H. hispida, Pursh. Alum-root.

Common through the south half of the state, and in the Red river valley ; extending northeast to the lake of the Woods, *Dawson,* the east end of Rainy lake, *Macoun,* and the upper Mississippi river, *Garrison.*

MITELLA, Tourn. MITER-WORT. BISHOP'S-CAP.

M. diphylla, L. Two-leaved Miter-wort.

Common, or frequent, through the south half of the state ; extending north at least to Fergus Falls, *Leonard,* Saint Cloud, *Campbell,* and the north shore of lake Superior, *Agassiz.*

M. nuda, L. Naked Miter-wort.

Common through the north half of the state ; extending south at least to Stearns county, *Campbell,* and Minneapolis, *Roberts.*

TIARELLA, L. FALSE MITER-WORT.

T. cordifolia, L. False Miter-wort.

Lapham. Lake City, *Miss B[illegible]*; Blue Earth county, *Geyer.* Infrequent.

CHRYSOSPLENIUM, Tourn. GOLDEN SAXIFRAGE.

C. Americanum, Schwein. Golden Saxifrage.

Lake Superior to the Mississippi, *Houghton.* Stearns county, *Mrs. Blaisdell.* Infrequent. North.

CRASSULACEÆ. ORPINE FAMILY.

PENTHORUM, Gronov. Ditch Stone-crop.

P. sedoides, L. Ditch Stone-crop.

Common, or frequent, through the south part of the state; extending north to the upper Mississippi river, *Garrison.*

SEDUM, Tourn. STONE-CROP. ORPINE.

S. *Telephium*, L. *Garden Orpine. Live-for-ever.*

Occasionally escaped from cultivation, Minneapolis, *Upham.*

HAMAMELACEÆ. WITCH-HAZEL FAMILY.

HAMAMELIS, L. WITCH-HAZEL.

H. Virginiana, L. Witch-Hazel.

Lapham. Southeastern Winona county, between Richmond and Dakota, *Winchell.* Rare. Southeast.

HALORAGEÆ. WATER-MILFOIL FAMILY.

MYRIOPHYLLUM, Vaill. WATER-MILFOIL.

M. spicatum, L. Water-Milfoil.

Frequent, or common, throughout the state.

M. verticillatum, L. Water-Milfoil.

Lapham. Blue Earth county, *Leiberg.* [In Manitoba, *Macoun.*] Infrequent.

M. heterophyllum, Michx. Water-Milfoil.

Lapham. Common southwestward, *Upham.*

[Proserpinaca palustris, L., has not yet been observed, but it probably occurs in this state.]

HIPPURIS, L. MARE'S-TAIL.

H. vulgaris, L. Mare's-Tail.

Frequent, often common, through the north half of the state; extending south at least to Little Falls (plentiful), *Upham*, Stearns county (abundant), *Mrs. Blaisdell*, and the Minnesota river near Traverse des Sioux, *Parry.*

ONAGRACEÆ. EVENING-PRIMROSE FAMILY.

CIRCÆA, Tourn. ENCHANTER'S-NIGHTSHADE.

C. Lutetiana, L. Tall Enchanter's-Nightshade.

Common throughout the state.

C. alpina, L. Low Enchanter's-Nightshade.

Common through the north half of the state; extending south at least to Anoka county, *Juni*, Minneapolis, *Herrick*, and Lake City, *Mrs. Ray*.

GAURA, L. GAURA.

G. biennis, L. Gaura.

Lake Pepin, *Miss Manning*. Southeast.

G. coccinea, Nutt.* Gaura.

Herman, Grant county, *Upham*, *Roberts*; ridge east of the Red river, near the international boundary (infrequent), *Scott*; plains of the Red river, *Drummond*, *Douglas*. West.

EPILOBIUM, L. WILLOW-HERB.

E. spicatum, Lam. (E. angustifolium, L.) Great Willow-herb. Fire-weed.

Common, or frequent, through the forest portion of the state; conspicuous on tracts of burned woodland. A canescent variety, besides the type, occurs at the lake of the Woods, *Dawson*.

E. origanifolium, Lam. (E. alpinum, L., var. majus, Wahl.) Willow-herb.

Winona county, *Holzinger*; Minneapolis, *Kassube*; Minneopa Falls, Blue Earth county, *Leiberg*. Rare southward, but probably frequent northward.

E. palustre, L., var. **lineare,** Gray. Linear-leaved Epilobium.

Common, or frequent, through the north half of the state, and southwestward; rare southeastward.

E. molle, Torr. Downy Willow-herb.

Blue Earth county, *Leiberg*; Minneapolis, *Simmons*; Anoka county, *Juni*. Infrequent.

E. coloratum, Muhl. Willow-herb.

Common throughout the state, especially northward.

ŒNOTHERA, L. EVENING-PRIMROSE.

Œ. biennis, L. Common Evening-Primrose.

Common throughout the state.

Œ. biennis, L., var. **grandiflora,** Lindl.

At the northwest side of Mille Lacs, *Upham*. [The var. muricata, Lindl., also quite certainly occurs in this state.]

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*GAURA COCCINEA, Nutt. Canescent, puberulent or glabrate; stems suffructicose and fastigiately branched from the base, 6 to 12 inches high, very leafy, ascending; leaves lanceolate, linear-oblong or linear, repand-denticulate or entire, 6 to 12 lines long, closely sessile; flowers in simple spikes terminating the leafy branches, rose-color, turning to scarlet; bracts linear, rather persistent, longer than the ovaries; calyx-segments linear-oblong, shorter than the narrow infundibuliform tube, as long as the roundish, unguiculate petals; fruit elliptical, sessile, short, terete, 4-sided above. *Porter and Coulter's Flora of Colorado.*

Frequent through the south part of the state; extending north to Minneapolis, *Roberts*. Anoka county, *Juni*, and Stearns county, *Garrison*; but not found in the Red river valley, *Upham*.

Œ. fruticosa, L. Sundrops.

Upper Mississippi river, *Garrison*. Rare. South.

Œ. pumila, L. (Including Œ. chrysantha, Michx.) Small Evening-Primrose.

Throughout the state, but infrequent. Lake of the Woods *Dawson*, *Burgess*; upper Mississippi river, *Garrison*; Goodhue county, *Sandberg*; Lake city, *Mrs. Ray*; Hesper, Iowa, *Mrs. Carter*; Pipestone county, *Mrs. Bennett*.

Œ. serrulata, Nutt. Evening-Primrose.

Common in all the prairie portion of the state; abundant in the Red river valley; extending northeast to the upper Mississippi, *Houghton*.

Œ. albicaulis, Nutt.[*] White, shrubby Evening-Primrose.

Brown's Valley (petals white, 1 inch long), *Upham*; near Muskoda, Clay county, *Leiberg*; Pembina, *Havard*. West.

LUDWIGIA, L. False Loosestrife.

L. polycarpa, Short & Peter. False Loosestrife.

Lake Pepin, *Miss Manning*; White Bear lake, Ramsey county, *Simmons*. Rare. Southeast.

L. palustris, Ell. Water Purslane.

St. Croix river, *Parry*; Blue Earth county, *Leiberg*. [Saskatchewan river, *Richardson*.] Infrequent.

LYTHRACEÆ. Loosestrife Family.

DIDIPLIS, Raf. Didiplis.

D. linearis, Raf. (Ammannia Nuttallii, Gray.) Didiplis.

Minnesota, *T. J. Hale*, in Gray's *Manual*. Southeast.

LYTHRUM, L. Loosestrife.

L. alatum, Pursh. Loosestrife.

Common, or frequent, through the southern third of the state; extending north to Stearns county, *Mrs. Blaisdell*, and the upper Mississippi river, *Garrison*.

[Nesæa verticellata, HBK., which occurs on the upper St. Croix river in Wisconsin, should be looked for in the adjoining part of Minnesota.]

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[*] ŒNOTHERA ALBICAULIS, Nutt. Perennial, puberulent or hirsute; stems usually 1 to 3 feet high, erect or ascending, with a white, membranous, shining bark; leaves very variable, linear or lanceolate, attenuate at the base, entire or more or less dentate; petals round-ovate, more or less unguiculate, entire, exceeding the stamens and equaling the pistil, often nearly white; capsule thickened at base, sessile, linear, divaricate, often flexuous or deflexed; seeds rather small, linear-lanceolate, smooth. *Porter and Coulter's Flora of Colorado.*

CACTACEÆ. CACTUS FAMILY.

OPUNTIA, Tourn. PRICKLY PEAR. INDIAN FIG. "CACTUS."

O. Rafinesquii, Engelm. Prickly Pear.

On rocks: at Taylor's Falls, *Miss Field, Miss Cathcart;* in section 17, Haven, Sherburne county, *Upham;* Redstone, near New Ulm, *Juni.* Rare. South. (The "prickly pear" which Keating and Sir John Richardson mention as abundant on the islands of the lake of the Woods is probably Echinocystis lobata. *Macoun.*)

O. Missouriensis, DC. Prickly Pear.

Section 17, Omro, Yellow Medicine county, *Upham;* Pipestone county (plentiful at the pipestone quarry), *Mrs. Bennett,* determined by *Dr. Engelmann.* Rare. South.

O. fragilis, Haw.* Prickly Pear.

Plentiful at the pipestone quarry, Pipestone county ("joints small, terete, with a terminal habit of growth, making them somewhat like a string of beads"), *Mrs. Bennett,* determined by *Dr. Engelmann;* Redwood Falls, *Miss Butler.* Rare. Southwest. (The range of this species is principally westward, on the upper Missouri and Yellowstone and thence south; but it occurs very rarely and locally farther east, being reported by *Swezey,* at Baraboo, Wisconsin.)

CUCURBITACEÆ. GOURD FAMILY.

SICYOS, L. ONE-SEEDED STAR-CUCUMBER.

S. angulatus, L. One-seeded Star-Cucumber.

Frequent through the south part of the state; extending north to St. Croix Falls, *Miss Field,* and Stearns county, *Garrison.*

ECHINOCYSTIS, Torr. & Gray. WILD BALSAM-APPLE.

E. lobata, Torr. & Gray. Wild Balsam-apple.

Common, or frequent, through the south half of the state, and in the Red river valley; extending northeast to Mille Lacs, *Upham,* the upper Mississippi river, *Garrison.* the lake of the Woods, *Dawson,* and Fort Francis, Rainy river, *Macoun.*

UMBELLIFERÆ. PARSLEY FAMILY.

HYDROCOTYLE, Tourn. WATER PENNYWORT.

H. Americana, L. Water Pennywort.

Lapham. Falls of the St. Croix, *Parry.* East.

H. umbellata, L. Water Pennywort.

North shore of lake Superior, *Juni.* Rare. East. [This species also occurs in Michigan.]

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*OPUNTIA FRAGILIS, Haw. The joints are small, ovate, compressed or turned, or even terete; 4 larger spines on the upper fully developed pulvilli cruciate, the upper one suberect, stouter and longer than the others, mostly yellowish-brown; on the lower margin 4-6 small white radiating spines; bristles few. Fruit apparently somewhat fleshy, getting dry much later with 20 to 28 pulvilli, almost naked, only the upper ones with a few short spines; seeds few, large, regular. *Engelmann and Bigelow,* in *Pacific Railroad Report.*

SANICULA, Tourn. SANICLE. BLACK SNAKEROOT.

S. Canadensis, L. Sanicle. Black Snakeroot.

Common, or frequent, through the south part of the state ; extending north at least to Pine and Sherburne counties (common), *Upham*, and Stearns county, *Campbell*.

S. Marylandica, L. Sanicle. Black Snakeroot.

Common, or frequent, throughout the state.

ERYNGIUM, Tourn. Eryngo.

E. yuccæfolium, Michx. Rattlesnake-Master. Button Snakeroot.

Common southeastward ; extending north to Rice and Nicollet counties, and west to Martin county and the southeast part of Brown county, *Upham*.

DAUCUS, Tourn. CARROT.

D. Carota, L. *Common Carrot.*

Occasionally spontaneous : Nicollet county, *Aiton*: Lake City, *Miss Manning*.

CARUM, L. Caraway.

C. Carui, L.* *Common Caraway.*

"Self-seeding" northeastward, *Clark*; not infrequently adventive. Todd, Isanti and Steele counties, *Upham*.

POLYTÆNIA, DC. POLYTÆNIA.

P. Nuttallii, DC. Polytænia.

Lapham. Rare. South.

HERACLEUM, L. COW-PARSNIP.

H. lanatum, Michx. Cow-Parsnip.

Frequent throughout the state; abundant north of lake Superior.

PEUCEDANUM, L. PEUCEDANUM. HOG'S-FENNEL.

P. nudicaule, Nutt.† Peucedanum. Hog's-Fennel.

Rock county, *Leiberg*; extending northeast to Saint Cloud, Stearns county (bluff of Mississippi river, near the Normal School) *Mrs. Blaisdell*, determined by *Prof. Asa Gray*. "Abundant on gravelly drift knolls in southwestern Minnesota and northwestern Iowa; remarkable for being the earliest flowering plant of that region, blooming almost as soon as the snow has disappeared." *Leiberg*. Southwest.

**Carum Carui*, L. Finely pinnately compound leaves ; stem-leaves with slender but short thread-shaped divisions ; white flowers; oblong, highly aromatic fruit. *Gray's Field, Forest, and Garden Botany.*

†PEUCEDANUM NUDICAULE, Nutt. Caulescent or sometimes scarcely so, minutely pruinose-pubescent, 3 to 15 inches high ; leafy only at base ; leaves bipinnate or ternate-bipinnate, the segments incisely lobed with usually rather broad and subacute divisions ; umbel somewhat capitate in flower, with 8 to 12 rays ; involure none ; involucels unilateral, of 6 to 10 membranously margined, more or less united bracts ; petals white, with attenuated apex and quasi-obcordate ; calyx-teeth short ; fruit pubescent, broadly oval, 3 to 4 lines long and 3 lines broad, the thickish wing more than half as wide as the seed ; vittæ 3 in the intervals, 6 upon the commissure, conspicuous ; seed flattened. . . . . . As observed by Dr, Gray, the plant does not accord with Nuttall's description, nor in all respects with the characters of the genus ; the lateral wings, however, are contiguous until the full maturity of the seed. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*

PASTINACA, Tourn. PARSNIP.

P. sativa, L. (*Peucedanum sativum*, Benth. & Hook.) *Common Parsnip.*

Occasionally adventive throughout the state. [Common in Manitoba, *Macoun*.]

ARCHEMORA, DC. COWBANE.

A. rigida, DC. Cowbane. Water Dropwort.

Upper Mississippi river, *Garrison;* Wabasha, *Gibson;* Hesper, Iowa, *Mrs. Carter*. (The var. ambigua, Torr. & Gray, probably also occurs in Minnesota. *Arthur*.) Infrequent. South.

CYMOPTERUS, Raf. Cymopterus.

C. glomeratus, Raf.[*] Cymopterus.

"Bend of Red river" [at Breckenridge], *Lapham* (according to his ticket of specimens in the herbarium of Harvard college, *Watson*). West.

ARCHANGELICA, Hoffm. ARCHANGELICA.

A. hirsuta, Torr. & Gray. Archangelica.

Anoka county, *Juni;* lake Pepin, *Miss Manning*. Rare. South.

A. atropurpurea, Hoffm. Great Angelica.

Common, or frequent, through the north half of the state, excepting perhaps far northwestward; found in Clay county in the Red river valley, *Gedge;* extending south to lake Pepin, *Miss Manning*, Cannon River Falls, *Blake*, *Sandberg*, and New Ulm, *Juni*.

SELINUM, L. HEMLOCK-PARSLEY.

S. Canadense, Michx. (Conioselinum Canadense, Torr. & Gray.) Hemlock-Parsley.

Upper Mississippi river, *Garrison*. Rare.

ÆTHUSA, L. FOOL'S PARSLEY.

Æ. Cynapium, L. *Fool's Parsley.*

Near Lake City, *Miss Manning;* Nicollet county, *Aiton*. Rare. South.

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[*] CYMOPTERUS, Raf. Calyx-teeth rather prominent and setaceous or lanceolate, minute or obsolete. Petals ovate, oblong or oblanceolate, inflexed, quasi-emarginate. Disk flattened around the styles, undulate-margined. Fruit ovate or elliptical, obtuse or retuse, subterete or slightly compressed dorsally; carpels semi-terete; ribs thick and elevated, all or only the lateral ones or those opposite to the calyx-teeth expanded into wings; vittæ numerous, narrow. Carpophore 2-parted, free or attached to the carpels. Seeds much compressed dorsally and more or less concave on the face.—Perennial and subcæspitose, with a thickened caudex; leaves pinnately decompound, with narrow, small or incisely pinnatifid segments; umbels compound, usually few-rayed; involucral bracts 1 to 2 or none; of the involucels several, very narrow or broad and membranous; flowers white or yellow. *Benth. & Hook.*

CYMOPTERUS GLOMERATUS, Raf. Root thick and fusiform; plant 3 to 8 inches high; caudex about 1 inch high, sometimes divided, bearing the leaves and peduncles at the summit; leaves on long petioles ternately divided and bipinnatifid, segments oblong-linear; rays of the umbel 4 to 6, very short; peduncles much shorter than leaves, 6 to 12 lines long; flowers white, those of the center abortive, pedicellate; leaflets of the palmately 5- to 7- parted involucel coherent at base and partly adnate to the rays of the umbellets; calyx-teeth subulate; fruit elliptical, 4 lines long, wings thickened and somewhat spongy, more or less obsolete; vittæ in each interval 3 or 4, in the commissure about 8. *Porter and Coulter's Flora of Colorado.*

Blue Earth river, *Parry*; Minneapolis, *Roberts*, *Upham*; extending north to the upper Mississippi river, *Garrison*. South.

T. aureum, Nutt. Meadow-Parsnip.

Common through the south half of the state; extending north to the upper Mississippi river, *Garrison*, and Sand Hill river, *Upham*; Pembina, *Chickering*, *Havard*.

T. aureum, Nutt., var. **apterum**, Gray. Meadow-Parsnip.

Minnesota river, *Parry*; abundant in Martin county, and in Emmet county, Iowa, *Cratty*. Perhaps the more common form of the species. South.

T. trifoliatum, Gray. Meadow-Parsnip.

Common through the south half of the state and northwestward; extending northeast to the upper Mississippi river, *Garrison*.

T. trifoliatum, Gray, var. **apterum**, Gray. Meadow-Parsnip.

Common throughout the Red river valley (the prevailing representative of this genus north of Sand Hill river), *Upham*; and common in Emmet county, Iowa, *Cratty*. Probably the most frequent form of the species in this state. (The var. atropurpureum, Gray, doubtless also occurs here, but must be rare.)

PIMPINELLA, L. BURNET SAXIFRAGE. GOLDEN ALEXANDERS.

P. integerrima, Benth. & Hook. (Zizia integerrima, DC.) Golden Alexanders.

Winona county, *Holzinger*; lake Pepin, *Miss Manning*; Faribault, *Miss Beane*; Martin county (plentiful), *Cratty*; Red river valley near Moorhead, *Leiberg*. Local.

CICUTA, L. WATER-HEMLOCK.

C. maculata, L. Spotted Cowbane. Musquash Root. Beaver-Poison.

Common, or frequent, throughout the state; abundant in the Red river valley. The roots of this and the following species are deadly poison.

C. virosa, L.* Water-Hemlock. Musquash-Poison.

Pembina, Red river valley ("this species exhibits forms running toward C. maculata,") *Chickering*; frequent from the Red river westward, on wet spots on the prairie, *Macoun*. Northwest.

C. bulbifera, L. Bulb-bearing Water-Hemlock.

Throughout the state; common northward, infrequent southward.

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*CICUTA VIROSA, L. Root-fibres slender. Rootstock short, hollow, with transverse partitions. Radical leaves bipinnate; ultimate leaflets or segments strapshaped-elliptical, entire or cleft, coarsely and unequally serrate. Stem erect, branched, hollow, 1 to 4 feet high. Lower leaves very large, triangular or lanceolate in outline, on thick, hollow petioles, with the pinnæ again pinnate; the secondary pinnæ undivided or 2- or 3-cleft or partite or pinnatifid, 1 to 3 inches long, varying in breadth from ⅛ to ⅝ inch; stem-leaves much smaller and less compound. Umbels flat-topped, lax, stalked, terminal or (from the growth of an axillary branch) opposite the leaves; rays of the umbels 1 to 2 inches long; pedicels ¼ to ⅜ inch long. Involucre none; involucel of numerous linear tapering leaves, shorter than the flowers. Flowers ⅛ inch across, white. Calyx-teeth ovate, much shorter than the petals, persistent. Petals roundish-obovate, spreading, slightly notched, with a small inflexed lobe. Cremocarp with the breadth greater than the length, which is one-tenth inch, reddish-brown, with the vittæ apparent when dry; ridges broad, little elevated; styles long, reflexed. *Sowerby's English Botany*, vol. iv

SIUM, L. WATER-PARSNIP.

S. cicutæfolium, Gmelin. (S. lineare, Michx.) Water-Parsnip.

Common, or frequent, throughout the state.

BERULA, Koch. WATER-PARSNIP.

B. angustifolia, Koch. (Sium angustifolium, L.) Water-Parsnip.

Cold springs, Mankato and Kasota, *Leiberg*. Infrequent. South.

CRYPTOTÆNIA, DC. HONEWORT.

C. Canadensis, DC. Honewort.

Common through the south part of the state, extending north to the upper Mississippi river; Fond du Lac, at west end of lake Superior, *Mrs. Herrick*.

OSMORRHIZA, Raf. Sweet Cicely.

O. longistylis, DC. Smoother Sweet Cicely.

Common throughout the state.

O. brevistylis, DC. Hairy Sweet Cicely.

Frequent throughout the state.

CONIUM, L. POISON HEMLOCK.

C. maculatum, L. *Poison Hemlock.*

Red river valley near Saint Vincent, *Scott*. Infrequent.

ARALIACEÆ. GINSENG FAMILY.

ARALIA, Tourn. GINSENG. WILD SARSAPARILLA.

A. racemosa, L. Spikenard.

Frequent throughout most of the state; common in Todd, Stearns and Brown counties; rare far northward.

A. hispida, Vent. Bristly Sarsaparilla. Wild Elder.

Common along the north shore of lake Superior, *Roberts, Juni*; extending south to the Falls of the St. Croix, *Parry*, and to Dakota county (frequent), *Upham*. Northeast

A. nudicaulis, L. Wild Sarsaparilla.

Common throughout the state.

A. quinquefolia, Decaisne & Planch. Ginseng.

Throughout the state, excepting perhaps northwestward; local, wanting in some districts, rare far northward; frequent, occasionally abundant, in the region of the upper Mississippi, and in Mille Lacs, Pine, Anoka, Hennepin and Brown counties. Large quantities of the aromatic, medicinal root of this plant, mostly dug by the Chippewa Indians, are bought every year in the north part of the state, the price being about a dollar per pound. It is mostly exported to China; and the annual exportation of this article from the United States, mainly from Pennsylvania, West Virginia, Ohio, Michigan, Wisconsin and Minnesota, amounts to about $700,000. *U. S. Agricultural Report for* 1877, p. 545.

A. trifolia, Decaisne & Planch. Dwarf Ginseng. Ground-nut.

East part of the state, extending north to Pine county, *Clark;* lake Pepin, *Miss Manning;* Nicollet county, *Leiberg*.

CORNACEÆ. DOGWOOD FAMILY.

CORNUS, Tourn. CORNEL. DOGWOOD.

C. Canadensis, L. Dwarf Cornel. Bunch-berry.

Abundant through the north part of the state; extending south to Fergus Falls, *Leonard*, Wadena county, *Upham*, Minneapolis, *Winchell*, *Roberts*, and Saint Paul (rare), *Miss Cathcart*; rare and local farther southeast, as in Wabasha county, *Holzinger*, *Miss Manning*.

C. circinata, L'Her. Round-leaved Dogwood.

Frequent, occasionally common, throughout the state.

C. sericea, L. Silky Cornel. Kinnikinnick.

Frequent throughout the state, excepting far northward. The inner bark of this and the next following species, the leaves of the bearberry (Arctostaphylos Uva-ursi), and leaves of sumach, gathered when they turn red, are each used by the Indians, under the name *Kinnikinnick*, to mix with their tobacco for smoking. *Parry* states that the bark of this species, wherever it is found, is preferred for this purpose; and that the bark of the next is commonly substituted for it by the Indians about lake Superior.

C. stolonifera, Michx. Red-osier Dogwood. Kinnikinnick.

Abundant through the north half of the state, and common southward to Winona and Mower counties, *Winchell*, and Blue Earth county, *Upham*; but scarcely reaching into Iowa (in Emmet county, rare, *Cratty*). The name of the Redwood river, which is a translation of its original Indian name, is said by Prof. A. W. Williamson to be probably derived from this or the preceding species of Kinnikinnick.

C. asperifolia, Michx. Rough-leaved Dogwood.

Blue Earth river, *Parry*, *Leiberg*; Cannon River Falls, *Blake*, *Sandberg*; Hesper, Iowa (common), *Mrs. Carter*. South.

C. paniculata, L'Her. Panicled Cornel.

Common through the south half of the state, and in the Red river valley; the most plentiful species of cornel in the Big Woods; extending north to Todd and Wadena counties (common), *Upham*, but not reported in the region of the upper Mississippi river and northeastward.

C. alternifolia, L. Alternate-leaved Cornel.

Frequent, occasionally common, throughout the state, excepting far northward, where it is rare (at Poplar river, north of lake Superior, *Juni*).

CAPRIFOLIACEÆ.* HONEYSUCKLE FAMILY.

LINNÆA, Gronov. LINNÆA. TWIN-FLOWER.

L. borealis, Gronov. Linnæa. Twin-flower.

Abundant north of lake Superior and thence to the sources of the Mississippi and northward; St. Louis river (usually having five perfect stamens), *Mrs. Herrick*; extending southwest to Wadena and Todd counties, *Upham*, and south to Minneapolis (at lake Calhoun), *Roberts*. In the northeast part of the state, "this pretty little plant, the

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*Advance sheets of a new part of Professor Gray's *Synoptical Flora of North America* (Vol. I, Part II; Caprifoliaceæ to Compositæ, inclusive), kindly sent by him while this catalogue was in process of being printed, have supplied very important corrections, especially in synonymy, as well as numerous additions, and valuable aid in the statements of geographic range.

Dwarf Cornel and the Clintonia are the most common small flowering plants found in the moss-carpeted forest." *Roberts.*

SYMPHORICARPOS, Dill. SNOWBERRY.

S. occidentalis, Hook. Wolfberry.

Common, often abundant, through the south half of the state; and northwesterly from Wadena county to the Red river valley, *Upham*, and the lake of the Woods, *Dawson*; infrequent northeastward. [North of lake Superior, *Agassiz.*]

S. racemosus, Michx. Snowberry.

Lake Pepin, *Miss Manning*; sources of the Mississippi, *Houghton*, *Garrison;* Red river valley, *Scott.* North.

S. racemosus, Michx., var. **pauciflorus**, Robbins. Snowberry.

Lake Pepin, *Miss Manning*; Minneapolis, *Winchell;* Stillwater, *Miss Field;* Redwood Falls, *Pemberton*; Isanti, Crow Wing and Wadena counties, *Upham.* North.

S. vulgaris, Michx. Indian Currant. Coral-berry.

Lake Pepin, *Miss Manning*; Blue Earth county, *Leiberg*; Hennepin county, *Herrick*; upper Mississippi river, *Garrison.* Rare. South.

LONICERA, L. HONEYSUCKLE. WOODBINE.

[L. grata, Ait., has been several times reported in this state ; but Gray's *Synoptical Flora of N. A.* shows that these references doubtless belong to some other species.]

L. Sullivantii, Gray. (L. flava, in part, Gray's *Manual.*) Yellow Honeysuckle.

Winona county, *Holzinger;* Lake City, *Miss Manning;* Cannon River Falls, *Blake, Sandberg*; Hennepin county, *Winchell;* Fergus Falls, *Leonard.*

L. glauca, Hill. (L. parviflora, Lam., and var. Douglasii, Gray, in *Manual.*) Yellow Honeysuckle. Crimson Honeysuckle.

Common, or frequent, throughout the state. This species with "crimson or deep dull purple" flowers has been noted by many observers in all parts of the state as a distinct variety, but Gray's *Synoptical Flora of N. A.* does not separate it from the type with greenish yellow flowers.

L. hirsuta, Eaton. Hairy Honeysuckle.

Lake Superior to the source of the Mississippi, *Houghton* ; common north of lake Superior, *Juni* ; Carlton county, *Roberts* ; Pembina, *Chickering*, *Havard.* North.

L. involucrata, Banks. Involucrate Honeysuckle.

Isle Royale, lake Superior ; doubtless also in northern Minnesota.

L. ciliata, Muhl. Fly-Honeysuckle.

North of lake Superior, *Juni*; Hennepin county, *Winchell;* frequent at Hesper, Iowa, *Mrs. Carter.*

L. cærulea, L. Mountain Fly Honeysuckle.

North shore of lake Superior (swamp near Port Arthur), *Macoun;* doubtless in northeastern Minnesota.

L. oblongifolia, Hook. Swamp Fly-Honeysuckle.

Kanabec county, *Upham.* North.

DIERVILLA, Tourn. BUSH-HONEYSUCKLE.

D. trifida, Mœnch. Bush-Honeysuckle.

Throughout the state; common, often abundant, northward, and frequent southward.

TRIOSTEUM, L. Fever-wort. Horse-Gentian.

T. perfoliatum, L. Fever-wort. Horse-Gentian.

Frequent through the south part of the state: extending north to Stearns and Todd counties, *Upham*.

ADOXA, L. Moschatel.

A. Moschatellina, L.* Moschatel. Hollow-root. Musk Crowfoot.

Beside Rolling Stone creek, three miles west of Minnesota City, Winona county, *Holzinger;* Vasa, Goodhue county, *Sandberg*. Rare. (Also found at Decorah, Iowa, and on the Rocky mountains in Colorado; common far north in British America.)

SAMBUCUS, Tourn. Elder.

S. Canadensis, L. Common Elder. Sweet Elder.

Common, or frequent, through the south half of the state, and rare northwesterly to Otter Tail and Becker counties.

S. racemosa, L. (S. pubens, Michx.) Red-berried Elder.

Common, or frequent, throughout the state.

VIBURNUM, L. Arrow-wood. Laurestinus.

V. Lentago, L. Sweet Viburnum. Sheep-berry. Black Haw.

Common through the south half of the state; extending north at least to Cass county (Fish-hook lake) and the White Earth reservation, *Garrison*, and to Pembina, *Chickering*, *Scott*, *Havard*.

V. cassinoides, L. (V. nudum, L., var. cassinoides, Torr. & Gray.) Withe-rod.

Upper Mississippi river and White Earth reservation, *Garrison*.

V. dentatum, L. Arrow-wood.

White Earth reservation, *Garrison;* Fergus Falls, *Leonard;* Minnesota river, *Parry;* Pipestone county, *Mrs. Bennett;* New Ulm (common), *Juni;* Minneapolis, *Griswold*, *Kassube;* lake Pepin, *Miss Manning*.

V. pubescens, Pursh. Downy Arrow-wood.

Common, or frequent, throughout the state.

V. acerifolium, L. Maple-leaved Arrow-wood. Dockmackie.

White Earth reservation, *Garrison;* Lake City, *Mrs. Ray*. Infrequent. Southeast

[V. pauciflorum, Pylaie, will doubtless be found in northern Minnesota; and perhaps also V. lantanoides, Michx.]

V. Opulus, L. Cranberry-tree. Bush or High Cranberry.

Common through the north half of the state and in the Big Woods; frequent thence southeastward; absent far southwest. Fruit much used for sauce. The name Pembina,

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*Adoxa, L. A genus of but a single species, widely distributed throughout the cooler parts of the globe. Flowers perfect. Tube of the calyx coherent with the lower part of the ovary, the limb slightly 2—3 cleft. Petals 4—5, inserted on the limb of the calyx, united at the base, spreading. Stamens 4—5, each filament 2-parted; the divisions bearing each a single-celled peltate anther. Styles 4—5, subulate. Fruit an herbaceous and juicy berry, 4—5-celled; each cell with a single suspended seed. Seeds compressed, with a membranaceous margin.

A. Moschatellina, L. A small perennial herb, with the odor of musk; root tuberous; radical leaves twice ternately compound, on long petioles, the cauline solitary, 1—2 ternate or incised; flowers 4—6 (greenish) in a terminal capitulum, the lateral ones mostly pentamerous, the terminal tetramerous. *Torrey and Gray's Flora of N. A.*, as borne first by a river, and thence given to a town and county, is stated by Keating to be from the Chippewa word for this fruit, "*anepeminan*, which name has been shortened and corrupted into Pembina (Viburnum Oxycoccos)." *Narrative of Long's Expedition*, vol. ii, p. 38; see also p. 127.

RUBIACEÆ. MADDER FAMILY.

GALIUM, L. BEDSTRAW. CLEAVERS.

G. Aparine, L. Cleavers. Goose-Grass.

Stearns county, *Mrs. Blaisdell;* Minneapolis, *Roberts;* Faribault, *Miss Beane;* Goodhue county, *Sandberg*; common at Hesper, Iowa, *Mrs. Carter*; frequent in Emmet county, Iowa, *Cratty*.

G. asprellum, Michx. Rough Bedstraw.

Common, or frequent, throughout the state.

G. concinnum, Torr. & Gray. Bedstraw.

Minneapolis, *Roberts;* Blue Earth county, *Leiberg;* Martin county (abundant), *Cratty;* Fergus Falls, *Leonard*. South.

G. trifidum, L. (G. tinctorium, L.) Small Bedstraw. Dyer's Cleavers.

Common, or frequent, throughout the state; exhibiting within our limits, the three varieties mentioned by Gray's *Manual*.

G. trifidum, L., var. **pusillum**, Gray. Small Bedstraw. Dyer's Cleavers.

Pembina, *Havard*. North.

G. trifidum, L., var. **latifolium**, Torr. Dyer's Cleavers.

Minneapolis, *Roberts*.

G. triflorum, Michx. Sweet-scented Bedstraw.

Throughout the state; common northward, frequent southward.

G. circæzans, Michx. Wild Licorice.

Lapham. Rare. Southeast.

G. lanceolatum, Torr. Wild Licorice.

Goodhue county, *Sandberg*. Rare. East.

G. boreale, L. Northern Bedstraw.

Abundant, or common, throughout the state.

CEPHALANTHUS, L. BUTTON-BUSH.

C. occidentalis, L. Button-bush.

Lapham. Taylor's Falls, *Roberts;* shore of lake Pepin in Wisconsin, *Miss Manning*. South.

MITCHELLA, L. PARTRIDGE-BERRY.

M. repens, L. Partridge-berry.

St. Croix river, *Parry*, *Miss Field;* upper Mississippi river, *Garrison;* northern Kanabec county (common), *Upham;* abundant at Taylor's Falls and Duluth, *Miss Cathcart*.

HOUSTONIA, Gronov. HOUSTONIA.

H. purpurea, L., var. **longifolia**, Gray. Houstonia.

Frequent throughout most of the state. Gooseberry river, lake Superior, *Juni;* St. Louis river, *Houghton*; lake of the Woods, *Dawson;* and thence south at least to

Chisago county (plentiful), *Upham*; Lake Pepin, *Miss Manning*; Blue Earth county, *Leiberg*; and the Upper Minnesota river, *Parry*.

H. purpurea, L., var. **ciliolata**, Gray. Houstonia.

Stearns county, *Campbell*. [Walhalla, northeastern Dakota, *Scott*.]

VALERIANACEÆ. VALERIAN FAMILY.

VALERIANA, Tourn. VALERIAN.

V. edulis, Nutt. Valerian.

Upper Mississippi river, *Parry*; Minneapolis, *Roberts*; Lake Pepin, *Miss Manning*; Faribault, *Miss Berne*; Winona county, *Holzinger*; Fillmore county, *Mrs. Carter*; Steele county (frequent), *Upham*.

[V. sylvatica, Banks, probably also occurs northward.]

VALERIANELLA, Tourn. (FEDIA, Gærtn.) CORN SALAD. LAMB LETTUCE.

V. chenopodifolia, DC. (F. Fagopyrum, Torr. & Gray.) Corn Salad. Lamb Lettuce.

Lake Pepin, *Miss Manning*; eastern Rice county (common), *Upham*. Southeast.

V. radiata, Dufresne. (F. radiata, Michx.) Corn Salad. Lamb Lettuce.

Lapham. Cannon River Falls, *Blake, Sandberg*. Rare. Southeast.

DIPSACEÆ. TEASEL FAMILY.

DIPSACUS, Tourn. Teasel.

D. sylvestris, Mill. *Wild Teasel*.

Lake Pepin, *Miss Manning*. Infrequent.

COMPOSITÆ. COMPOSITE FAMILY.

VERNONIA, Schreb. IRON-WEED.

V. Noveboracensis, Willd. Iron-weed.

Upper Mississippi river, *Houghton*; Hennepin county, *Herrick*; St. Paul, *Kelley*; Blue Earth county, *Leiberg*. Southeast.

V. fasciculata, Michx. Iron-weed.

Common through the south half of the state and in the Red river valley, *Upham*.

LIATRIS, Schreb. BUTTON SNAKEROOT. BLAZING-STAR. GAY FEATHER.

L. squarrosa, Willd. Blazing-Star.

Common through the south part of the state; extending north to the upper Mississippi river, *Garrison*.

[L. squarrosa, Willd., var. intermedia, DC. (heads narrow; bracts of the involucre erect or little spreading, less prolonged), probably also occurs in this state, according to Gray's *Synoptical Flora of N. A.*]

L. cylindracea, Michx. Button Snakeroot. Blazing-Star.

Common, or frequent, through the south half of the state; extending north to the upper Mississippi river, *Houghton*, *Garrison*, and Fergus Falls, *Leonard*.

L. scariosa, Willd. Blazing-Star. Gay Feather.

Common, often abundant, through the south half of the state, being the most plentiful species southwestward; also common in the Red river valley, especially north of Sand Hill river and along the old Pembina trail, *Upham;* extending northeast to the upper Mississippi river, *Houghton*. (A remarkable form of this species, bearing the heads at the end of leafy, ascending branches, 2 to 6 inches long, was found in a bog near Mankato by *Mr. Leiberg*. White-flowered specimens have been collected by *Mr. W. H. Kelley*, at Dellwood, White Bear lake, Ramsey county.)

L. spicata, Willd. Blazing-Star.

Lake Pepin, *Miss Manning;* Minneapolis, *Kassube;* Anoka county, also New Ulm, *Juni;* Blue Earth county, *Leiberg*, *Gedge;* Kandiyohi county, *Upham;* Fergus Falls, *Leonard*. Less frequent than the last and the next. South.

L. pycnostachya, Michx. Blazing-Star.

Common through the south half of the state; very abundant in the Red river valley in Clay and Norman counties, but rare or infrequent north of Sand Hill river, *Upham*. This species is three weeks earlier in flowering than L. scariosa, and prefers moister ground.

L. punctata, Hook.* Blazing-Star.

Generally common on the drier portions of the prairie, in the west part of the state, extending east to Martin county, *Cratty*, Saint Peter, *Gedge*, and the St. Croix river, *Swezey*; but infrequent north of the Sand Hill river; seen in Kittson county only at the Ridge, twelve miles east of Saint Vincent, *Upham*, *Dawson*; also found at Pembina, *Havard*.

KUHNIA, L. Kuhnia.

K. eupatorioides, L. Kuhnia.

Frequent, or common, through the south part of the state; Goodhue county, *Sandberg*; Hennepin county, *Herrick;* Blue Earth county, *Leiberg*; common southwestward (leaves broadly lanceolate, deeply toothed), *Upham;* extending northwest to Devil's lake, Dakota, *Geyer*.

K. eupatorioides, L., var. **corymbulosa,** Torr. & Gray.† Kuhnia.

Prairies and plains, Illinois to Dakota and Nebraska, and south to Alabama and Texas, *Gray's Synoptical Flora of N. A.*; therefore doubtless in southern and western Minnesota.

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* LIATRIS PUNCTATA, Hook. Stems 8 inches to 3 feet high, from a thick, knotted, fusiform root, glabrate, leafy to the top; leaves linear, rigid, strongly punctate on both sides, glabrous or their margins somewhat ciliate, lower ones 3 to 5 inches long, slightly 3-nerved, 1 to 3 lines wide, pungently acute; heads in a dense spike, 4 to 10 inches long, 4- to 6-flowered; flowers reddish-purple; scales of the cylindraceous involucre oblong, strongly punctate, imbricated, appressed, with mucronate, acuminate, rather spreading tips, margins woolly-ciliate; bristles of the pappus about 30, purplish or white, very plumose; achenia hairy. *Porter and Coulter's Flora of Colorado.*

†KUHNIA EUPATORIOIDES, L., var. CORYMBULOSA, Torr. & Gray. A foot or two high, stouter, somewhat cinereous-pubescent or tomentulose: leaves rather rigid and sessile, from oblong to lanceolate, coarsely veiny: heads rather crowded. *Gray's Synoptical Flora of N. A.*

E. purpureum, L. Joe-Pye Weed. Trumpet-weed.

Common throughout the state.

E. purpureum, L., var. **maculatum,** Darl.[*] Joe-Pye Weed. Trumpet-weed.

Frequent, or common, throughout the state.

E. altissimum, L. Tall Boneset.

Lapham. Goodhue county, *Sandberg*; Blue Earth county, *Leiberg*, *Gedge*. Rare. South.

E. perfoliatum, L. Thoroughwort. Boneset.

Common, or frequent, through the south half of the state; upper Mississippi river, *Garrison*; less frequent farther north to the lake of the Woods, *Dawson*. Well known as a bitter tonic.

E. serotinum, Michx. Thoroughwort. Boneset.

Lapham. Todd county (frequent), *Upham;* Martin county, and Emmet county, Iowa (common), *Cratty.* South.

E. ageratoides, L. f. White Snake-root.

Common, or frequent, throughout the state.

PETASITES, Tourn. (NARDOSMIA, Cass.) SWEET COLTSFOOT.

P. sagittata, Gray.[†] (N. sagittata, Hook.) Sweet Coltsfoot.

Red river valley near Saint Vincent (in a "low damp thicket; in full bloom in the first week of May; seed nearly ripe, June 4; flower with an odor like that of Cratægus, white, tinged with purple"), *Dawson;* also on Roseau river, *Scott.* Rare. Northwest.

[P. palmata, Gray, (N. palmata, Hook.) probably also occurs in Minnesota.]

TUSSILAGO, Tourn. COLTSFOOT.

T. Farfara, L. *Coltsfoot.* *"Ginger-root."*

Northeastward, "much used as a cough medicine," *Clark*; lake Pepin, *Miss Manning.*

ADENOCAULON, Hook. ADENOCAULON.

A. bicolor, Hook. Adenocaulon.

Stearns county, *Garrison.* Rare. North.

ASTER, Tourn. STARWORT. ASTER.

A. corymbosus, Ait. Aster.

Hennepin county, *Roberts.* [North of lake Superior, *Agassiz.*] Infrequent.

A. macrophyllus, L. Large-leaved Aster.

Abundant north of lake Superior, *Roberts;* lake of the Woods, *Dawson*; upper

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[*] EUPATORIUM PURPUREUM, L., var. MACULATUM, Darl. Common in open ground, 3 or 4 feet high, often roughish-pubescent: stem commonly purple, striate or sulcate; leaves somewhat rugose, 3—5-nate: inflorescence more compact and depressed. . . . . The most widely distributed form. *Gray's Synoptical Flora of N. A.*

[†] PETASITES SAGITTATA, Gray. Leaves from deltoid-oblong to reniform-hastate, from acute to rounded-obtuse, repand-dentate, very white-tomentose beneath, when full grown 7 to 10 inches long: heads short-racemose, becoming corymbose: ligules equalling or shorter than the disk. *Gray's Synoptical Flora of N. A.*

Mississippi river, *Garrison*; Todd and Crow Wing counties (common), *Upham;* White Bear, Ramsey county, *Simmons*. North and east.

A. sericeus, Vent. Silky Aster.

Common through the south half of the state, and frequent in the Red river valley, *Upham*; extending northeast to the upper Mississippi river, *Garrison*, and the mouth of Rainy river, *Macoun*.

A. patens, Ait. Aster.

Upper Mississippi river, *Garrison;* Fergus Falls, *Leonard;* Douglas county, *Mrs. Terry;* Anoka county, *Juni;* Blue Earth county, *Gedge*. Infrequent. South.

A. lævis, L. Smooth Aster.

Frequent, or common, in both var. lævigatus and var. cyaneus, of Gray's *Manual*, through the south half of the state and in the Red river valley; extending northeast to Crow Wing county, *Upham*.

A. azureus, Lindl. Azure Aster.

Prairies of the Blue Earth river, *Geyer;* Goodhue county, *Sandberg;* Minneapolis, *Twining*, *Roberts;* Douglas county, *Mrs. Terry*. South.

A. Shortii, Boott. Short's Aster.

Lapham. Rare. Southeast.

A. undulatus, L. Wavy Aster.

Lapham. Douglas county, *Mrs. Terry;* Blue Earth county, *Gedge*. Infrequent. South.

A. cordifolius, L. Heart-leaved Aster.

Common in woods through the south half of the state, and in the Red river valley; only reported northeastward by *Juni* at Little Marais, lake Superior.

A. sagittifolius, Willd. Arrow-leaved Aster.

North of lake Superior (abundant), *Roberts*, *Juni;* Douglas county, *Mrs. Terry;* falls of the St. Croix, *Parry;* Minneapolis, *Roberts;* lake Pepin, *Miss Manning;* Minnesota river, *Geyer;* Emmet county, Iowa (common), *Cratty;* and westward into Dakota, *Gray's Synoptical Flora of N. A.*

A. Drummondii, Lindl.* Drummond's Aster.

Open grounds and border of woods, Illinois and Minnesota to Texas. Forms pass into A. sagittifolius. *Gray's Synoptical Flora of N. A.*

A. ericoides, L., var. **villosus**, Torr. & Gray. Heath-like Aster.

Blue Earth county, *Gedge*. South.

A. multiflorus, Ait. Many-flowered Aster.

Common, often abundant, through the south half of the state and in the Red river valley; extending northeast to Todd and Crow Wing counties (common), *Upham*.

A. dumosus, L. Aster.

Lake Pepin, *Miss Manning;* Blue Earth county, *Gedge*. Infrequent. Southeast.

A. vimineus, Lam. (A. Tradescanti, in Gray's *Manual*.) Aster.

Lake Pepin, *Miss Manning;* Douglas county, *Mrs. Terry;* common southward and westward, *Juni*, *Upham*.

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*ASTER DRUMMONDII, Lindl. Pale with a fine and mostly soft cinereous pubescence; leaves from cordate to cordate-lanceolate and mostly on margined petioles, or the small uppermost lanceolate and sessile by a narrow base, obtusely or acutely serrate (the large 4 inches, smaller about an inch long), sometimes scabrous above: bracts of the involucre acute or acutish; rays violet-blue or paler, 3 to 5 lines long. *Gray's Synoptical Flora of N. A.*

A. Tradescanti, L.* Tradescant's Aster.

Open grounds, Canada to Virginia, Illinois and Saskatchewan. Nearly allied with the two preceding and the two following species. *Gray's Synoptical Flora of N. A.*

A. diffusus, Ait. (A. miser, in *Manual.*) Aster.

Throughout the state. Common north of lake Superior, and at Minneapolis, *Roberts;* lake of the Woods, *Dawson;* Todd county, *Upham;* St. Croix river, *Parry;* Goodhue county, *Sandberg;* Blue Earth county, *Leiberg;* Emmet county, Iowa, *Cratty*.

A. paniculatus, Lam. (A. simplex, and A. tenuifolius, partly, in *Manual.*) Panicled Aster.

Common, or frequent, throughout the state; especially plentiful westward.

A. polyphyllus, Willd.† (A. tenuifolius, partly, in *Manual.*) Aster.

Notes of A. tenuifolius, as described in Gray's *Manual*, probably belonging in part to A. polyphyllus, are as follows: upper Mississippi river, *Houghton;* Fergus Falls, *Leonard;* Douglas county, *Mrs. Terry;* Wadena and Todd counties, *Upham;* Blue Earth county, *Leiberg;* Emmet county, Iowa (rare), *Cratty*.

A. salicifolius, Ait. (A. carneus, in *Manual.*) Aster.

Douglas county, *Mrs. Terry;* Lac qui Parle, *Upham;* Anoka county, *Juni*. [Also northwest to the Saskatchewan river and eastern Montana, *Gray's Synoptical Flora of N. A.*]

A. junceus, Ait. (A. æstivus, in *Manual.*) Aster.

Throughout the state, but infrequent. Blue Earth county, *Leiberg;* Goodhue county, *Sandberg;* Anoka county, *Juni;* Douglas county, *Mrs. Terry;* Pembina, *Havard*. [North of lake Superior, *Agassiz.*]

A. longifolius, Lam.‡ Long-leaved Aster.

This species (not the one so named in Gray's *Manual*, which is the next; more nearly related with A. junceus) doubtless occurs in northern Minnesota.

A. Novi-Belgii, L. (Including A. longifolius of Gray's *Manual.*) New York Aster.

Spirit lake, Iowa, *Geyer;* Blue Earth county, *Gedge;* southwestward (frequent), *Juni;* Douglas county, *Mrs. Terry;* Fergus Falls, *Leonard;* upper Mississippi river, *Garrison;* Pembina, *Havard*.

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* ASTER TRADESCANTI, L. Stem slender, 2 to 4 feet high, with numerous erect or ascending branches and branchlets: leaves lanceolate or linear, slightly serrate or entire, thinnish: small heads numerous, corymbosely or somewhat racemosely paniculate [the most notable distinction from A. vimineus]; only two or three lines high: bracts of the involucre linear, acutish, partly green at tip and down the back: rays white, or sometimes tinged with lilac, only about 2 lines long. *Gray's Synoptical Flora of N. A.*

†ASTER POLYPHYLLUS, Willd. Mostly tall (4 or 5 feet high), with virgate branches, glabrous: cauline leaves narrowly lanceolate or linear (4 or 5 inches long, quarter to half inch wide); those of flowering branchlets small and subulate-linear: heads paniculate (4 lines high): involucre nearly hemispherical; involucral bracts lanceolate-subulate, outer successively shorter, rather rigid, with green nearly erect tips; rays numerous, bright white, disposed to turn rose-purplish, 4 lines long: akenes minutely pubescent. *Gray's Synoptical Flora of N. A.*

‡ ASTER LONGIFOLIUS, Lam. A foot to a yard high, glabrous or pubescent, leafy: leaves elongated-lanceolate to linear-lanceolate, entire or sparingly serrulate, 3 to 7 inches long, tapering to both ends: involucre 4 to 5 lines high, little or not at all imbricated; its bracts all of nearly equal length, some looser, outermost not rarely quite herbaceous: rays 3 or 4 lines long, violet or purplish, rarely almost white. . . . . Low grounds or along streams, Labrador to Montana, Slave Lake, south to Canada and N. New England. *Gray's Synoptical Flora of N. A.*

A. puniceus, L. Aster.

Common throughout the state, excepting northwestward; extending to Fergus Falls, *Leonard*, and into Dakota, *Gray's Synoptical Flora*; but not observed in the Red river valley, *Upham*.

A. puniceus, L., var. **lucidulus**, Gray. (var. vimineus, Torr. & Gray.) Aster.

Frequent in the south half of the state.

A. prenanthoides, Muhl. Aster.

Lapham. Common in the vicinity of Hesper, Iowa, adjoining Houston and Fillmore counties, *Mrs. Carter*. Southeast.

A. oblongifolius, Nutt. Aster.

Douglas county, *Mrs. Terry*; Fort Snelling, *Roberts*; Minneopa falls, Blue Earth county, *Upham*; Pipestone county, *Mrs. Bennett*. South.

[A. amethystinus, Nutt., occurs in Iowa, and probably also in Minnesota, *Arthur*.]

A. Novæ-Angliæ, L. New England Aster.

Minneapolis, *Twining*, *Roberts*; lake Pepin, *Miss Manning*; common at Hesper, Iowa, *Mrs. Carter*; Blue Earth county, *Gedge*; Rock county, *Leiberg*. [Upper Missouri river, *Geyer*, and Saskatchewan, *Gray's Synoptical Flora of N. A.*] South and west.

A. modestus, Lindl.* Aster.

Moist woods, Oregon to British Columbia on the Pacific, and east to Saskatchewan and Pembina (*Macoun*), *Gray's Synoptical Flora of N. A.* Northwest.

[A. GRAMINIFOLIUS, Pursh., is ERIGERON HYSSOPIFOLIUS, Michx., in *Gray's Synoptical Flora of N. A.*, and will be found accordingly under that genus.]

[A. acuminatus, Michx., should be looked for in northern Minnesota.]

A. ptarmicoides, Torr. and Gray. Aster.

Abundant, or common, throughout the state. [The var. lutescens, Gray, with "rays pale yellow, small," which occurs in Manitoba and northern Illinois (*Gray's Synoptical Flora of N. A.*), will probably be found also in Minnesota.]

A. angustus, Torr. and Gray. Aster.

Lapham. Clay county, in the Red river valley, *Gedge*, determined by *Watson*. Northwest.

A. linariifolius, L. (Diplopappus linariifolius, Hook.) Double-bristled Aster.

Lapham. Rare. East.

A. umbellatus, Mill. (Diplopappus umbellatus, Torr. & Gray.) Double-bristled Aster.

Throughout the state: abundant northward, common or frequent southward.

A. umbellatus, Mill., var. **pubens**, Gray. Double-bristled Aster. *

Lower face of the oblong-lanceolate leaves tomentulose-pubescent, also usually the flowering branchlets.—Saskatchewan to upper Michigan. *Gray's Synoptical Flora of N. A.*

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* ASTER MODESTUS, Lindl. Merely pubescent or glabrate: stem more slender than in the two preceding species, 2 feet high: leaves thinnish, lanceolate or broader (2 to 4 inches long), sparingly and acutely serrate or denticulate, very acute, mostly narrowed to a sessile or partly clasping but not auriculate base: heads fewer and smaller than in the preceding, hemispherical, numerous and usually thyrsoidly or cymosely congested at the summit of the simple very leafy stem: bracts of the involucre less numerous, loose, and more or less herbaceous (or somewhat colored) almost from the base, linear-attenuate, all equalling the disk: rays numerous and narrow, pale blue: style-appendages lanceolate: akenes hirsute. *Gray's Synoptical Flora of N. A.*

ERIGERON, L. FLEABANE.

E. hyssopifolius, Michx. (Aster graminifolius, Pursh.) Fleabane.

North shore of lake Superior, *Juni*; between the lake of the Woods and Red river, *Dawson*. North.

E. Canadensis, L. Horse-weed. Butter-weed.

Common throughout the state.

E. divaricatus, Michx. Dwarf Fleabane.

Open grounds and river banks, Indiana to Minnesota, Nebraska and Texas. *Gray's Synoptical Flora of N. A.*

E. acris. L. Fleabane.

North shore of lake Superior, *Macoun*; doubtless in northern Minnesota. [Perhaps the var. DRŒBACHENSIS, Blytt, which has a similar range with the typical species. Somewhat glabrous, or even quite so: involucre also green, naked, at most hirsute only at the base, often minutely viscidulous: slender rays somewhat slightly exserted, sometimes minute and filiform and shorter than the pappus. . . . . North shore of lake Superior, etc. *Gray's Synoptical Flora of N. A.*]

E. bellidifolius. Muhl. Robin's Plantain.

Frequent southward; extending north at least to Isanti county, *Upham*, and Clay county and Detroit, Becker county, *Gedge*.

E. Philadelphicus, L. Common Fleabane.

Frequent, occasionally common, throughout the state.

E. glabellus. Nutt. Fleabane.

Goodhue county, *Sandberg*; Red river valley near Saint Vincent, *Dawson*, *Scott*. [Devil's lake, Dakota. *Geyer*.] West.

E. annuus. Pers. Daisy Fleabane. Sweet Scabious.

St. Croix Falls, *Miss Field*; Minneapolis, *Miss Butler*; lake Pepin, *Miss Manning*; frequent in the vicinity of Hesper, Iowa, adjoining the southern boundary of Houston and Fillmore counties, *Mrs. Carter*. This species reaches its northwest limit in southeastern Minnesota; it was not observed, though carefully looked for, throughout the remainder of the state.

E. strigosus, Muhl. Daisy Fleabane.

Throughout the state; common southward, infrequent northward.

[The species referred to the genus DIPLOPAPPUS, Cass., in Gray's *Manual*, are included under ASTER in his *Synoptical Flora of N. A.*; and in this catalogue they are placed at the end of that genus.]

BOLTONIA, L'Her. BOLTONIA.

B. asteroides, L'Her. (Including B. glastifolia, L'Her.) Boltonia.

Common through the south part of the state; extending north at least to Minneapolis, *Williams*, Alexandria, *Mrs. Terry*, Fergus Falls, *Leonard*, and Devil's lake, Dakota, *Geyer*. South and west.

GUTIERREZIA, Lagasca. GUTIERREZIA.

G. Euthamiæ, Torr. & Gray.[*] Gutierrezia.

Red river valley near Saint Vincent, *Scott*, determined by *Watson*. West.

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[*] GUTIERREZIA, Lagasca. Heads small or middle-sized, 6- to 90-flowered, the rays pistillate, fertile, the disk-flowers tubular, perfect and fertile. Involucre varying from narrowly obconic to broadly hemispherical, the scales closely imbricated in several series, rigid, and with greenish herbaceous tips. Receptacle naked. Corollas yellow,

SOLIDAGO, L. GOLDEN-ROD.

S. bicolor, L. Golden-rod.

Lapham. The typical species is rare.

S. bicolor, L., var. **concolor,** Gray. Golden-rod.

Common on rocks, north shore of lake Superior, *Roberts, Juni*; northwest side of Mille Lacs, *Upham*; falls of the St. Croix, *Parry*.

S. latifolia, L. Golden-rod.

Common, or frequent, throughout the state.

S. cæsia, L. Golden-rod.

Lake Minnetonka, *Roberts, Herrick*; lake Pepin, *Miss Manning*. Infrequent. Southeast.

S. puberula, Nutt. Golden-rod.

Lapham. Le Sueur county, *Gedge*; Pembina, *Havard*. A golden-rod agreeing well, except as to geographical limits, with the description of this species in Gray's *Manual*, is common on dry prairies throughout southern Minnesota, extending northeast to Todd and Crow Wing counties, *Upham*.

S. uliginosa, Nutt. (S. stricta, in Gray's *Manual*.) Golden-rod.

North of lake Superior (common), *Roberts*; Anoka county, *Juni*; St. Croix river, *Parry*; lake Pepin, *Miss Manning*. North.

S. speciosa, Nutt. Golden-rod.

Minneapolis, *Roberts*; lake Pepin, *Miss Manning*; Blue Earth county, *Leiberg*. South.

S. speciosa, Nutt., var. **angustata,** Torr. & Gray. Golden-rod.

Stearns county, *Campbell*; Emmet county, Iowa (rare), *Cratty*.

S. speciosa, Nutt., var. **rigidiuscula,** Torr. & Gray. Golden-rod.

A form of the var. angustata, growing in dry open places, with more rigid and rougher-edged small leaves. Minnesota to Nebraska and Texas. *Gray's Synoptical Flora of N. A.*

S. Virgaurea, L., var. **alpina,** Bigelow. Golden-rod.

Lapham. North.

[S. humilis, Pursh (S. Virgaurea, L., var. humilis, Gray), and S. macrophylla, Pursh (S. thyrsoidea, E. Meyer), probably also occur, with the preceding, in northeastern Minnesota.]

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of the ray oval, oblong or linear, of the disk funnel-shaped, 5-toothed, the teeth erect or recurved. Branches of the style in the ray-flower, linear, smooth, the stigmatic lines extending to the top; in the disk, with the hairy appendages shorter or several times longer than the stigmatic portion. Achenia oblong or obconic, terete or somewhat compressed. Pappus of the disk composed of several oblong or linear chaffy scales, or reduced to a lacerate coroniform border, of the ray similar to that of the disk, but commonly smaller or sometimes obsolete.—Mostly perennial and suffruticose plants of North and South America, with glabrous and often resinous-dotted or varnished linear and entire or broader and denticulate leaves.

G. EUTHAMIÆ, Torr. and Gray. Stems 6 to 15 inches high, numerous from a woody and much-branched base, striated; leaves crowded, narrowly linear, 1 to 2 inches long ¼ to 1 line wide, 1-nerved, minutely scabrous, punctate, resinous, and sometimes varnished; heads in little clusters forming compound corymbs; involucres scarcely 2 lines long and 1 line broad, narrowly obovate; flowers of the ray 2 to 5, of the disk 3 to 6; pappus of 9 or 10 obtuse unequal erose-denticulate chaffy scales, a little shorter than the achenium.—Plant growing in dense tufts, when in flower forming a conspicuous yellow round-topped bushy clump. *Eaton* in *Bot. Rep. of King's Expl. of the Fortieth Parallel.*

S. rigida, L. Golden-rod.

Abundant through the south half of the state, and in the Red river valley, extending northeast to Crow Wing county, *Upham.* Usually from one and a half to two feet high on prairies, where it most abounds; but from three to five feet high in woods and thickets.

S. Riddellii, Frank. Riddell's Golden-rod.

Minneapolis, *Williams*; Rapidan Rapids, Blue Earth county, *Upham*; peat bogs, Blue Earth county, *Leiberg*; common in Emmet county, Iowa, *Cratty.* South.

S. neglecta, Torr. & Gray. Golden-rod.

Lapham. Infrequent. Southeast.

S. patula, Muhl. Golden-rod.

Lapham. Infrequent. Southeast.

S. juncea, Ait. (S. arguta, var. juncea, Gray, in *Manual.*) Golden-rod.

Common, or frequent, throughout the state, excepting perhaps near its south side; flowering early.

S. juncea, Ait., var. **scabrella,** Gray. (S. arguta, var. scabrella, Torr. & Gray, in *Manual.*) Golden-rod.

Rice county, *Upham.* Probably infrequent. Southeast.

S. arguta, Ait. (S. Muhlenbergii, Torr. & Gray.) Golden-rod.

North of lake Superior, *Juni.* Rare. East.

S. rugosa, Mill. (S. altissima, in *Manual.*) Golden-rod.

Blue Earth county, *Gedge.* Infrequent.

S. ulmifolia, Muhl. Golden-rod.

Lapham. Falls of the St. Croix, *Parry.* Infrequent. Southeast.

S. nemoralis, Ait. Golden-rod.

Common, often abundant, throughout the state.

S. nemoralis, Ait., var. **incana**, Gray.* Golden-rod.

Plains of Minnesota and Dakota (*Nicollet*, etc.) to the Rocky Mountains of Montana and Colorado. *Gray's Synoptical Flora of N. A.*

S. radula, Nutt. Golden-rod.

Blue Earth county, *Leiberg*; Stearns county, *Campbell*; Yellow Medicine county (frequent), *Upham.* South.

S. Missouriensis, Nutt. Golden-rod.

Saint Paul, *Kelley*; Minneapolis, *Twining*, *Roberts*, *Simmons*; Martin county, and Emmet county, Iowa (abundant), *Cratty*; high prairies towards the sources of the Minnesota river, *Geyer*; Red river valley, *Scott.* South and west.

S. Canadensis, L. Golden-rod.

Common throughout the state. [The var. procera, Torr. & Gray, probably also occurs in Minnesota, especially northwestward.]

S. serotina, Ait., var. **gigantea**, Gray. (S. serotina, in *Manual.*) Golden-rod.

Common, or frequent, throughout the state.

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* SOLIDAGO NEMORALIS, Ait., var. INCANA, Gray. Dwarf, a span to a foot high: leaves oval or oblong, rigid, more or less canescent, sometimes rather strongly serrate, sometimes mostly entire: racemiform clusters erect or the lower somewhat spreading, collected in a dense oblong or conical thyrsus. *Gray's Synoptical Flora of N. A.*

S. serotina, Ait. (S. gigantea, in *Manual.*) Golden-rod.

Common, or frequent, throughout the state, especially north of lake Superior, *Roberts,* and in the Red river valley, *Upham.*

S. lanceolata, L. Golden-rod.

Common throughout the state; abundant in the Red river valley.

S. occidentalis, Nutt.* Golden-rod.

Sandy soil, Saint Peter, Nicollet county, *Leiberg;* determined by *Watson* as "probably" this species. Infrequent. Southwest.

APLOPAPPUS, Cass. APLOPAPPUS.

A. spinulosus, DC.† Aplopappus.

Upper Minnesota river, *Geyer;* Yellow Medicine county, *Upham.* Southwest.

GRINDELIA, Willd. GRINDELIA.

G. squarrosa, Dunal.‡ Grindelia.

Common, or frequent, in the west edge of the state, from Rock county, *Leiberg,* and Pipestone City to Saint Vincent, *Upham;* also plentiful on the quartzite ridge in northern Cottonwood county, *Upham.* West.

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*SOLIDAGO OCCIDENTALIS, Nutt. Smooth; stems 2 to 3 feet high, paniculately corymbose at the summit, leafy; leaves linear-lanceolate, obscurely 3- to 5-nerved, minutely scabrous on the edges, the larger ones 4 inches long, 3 lines broad; heads rather large, pedicellate in many small corymbs, broadly obconic; involucral scales loosely imbricated in about 3 series, oblong-linear, the straight tips greenish, ciliolate, rather acute; rays 15 to 25, very small; disk-flowers 10 to 15; achenia pubescent. *Eaton* in *Bot. Rep. of King's Expl. of the Fortieth Parallel.*

†APLOPAPPUS, Cass. Heads solitary, terminating the branches, or sometimes corymbosely or spicately clustered, many-flowered, rarely several-flowered, heterogamous and with fertile rays, or very rarely homogamous, the rays being wanting. Involucre imbricated, the scales with or sometimes without herbaceous or foliaceous tips. Receptacle flat or flattish, foveolate or alveolate-dentate. Appendages of the style-branches triangular-lanceolate, or in the N. American species more commonly elongated subulate. Akenes varying from turbinate to linear, terete, angled, or more or less compressed. Pappus simple, of copious and unequal rigid capillary (scabrous or almost barbellate) bristles.—Herbs or low under-shrubby plants, of various aspect and foliage; with yellow flowers, and pappus varying from tawny to reddish, very rarely bright white. Leaves alternate, rigid. *Gray* in *Botany of California,* from *Proc. Am. Acad.,* vol viii.

A. SPINULOSUS, DC. Herbaceous, canescent with a soft, minute, woolly pubescence; stems many, 1 to 2 feet high, corymbosely branched above; leaves small, 9 to 12 lines long, rigid, pinnately or somewhat bi-pinnately parted, segments short, linear-subulate, mucronate with a short bristle; heads small, subglobose, terminating the numerous branchlets; involucre shorter than the disk, scales subulate-lanceolate, mucronulate, imbricated in 3 or 4 series, appressed, canescent; rays 20 to 30; corolla of the disk with very short teeth; pappus pale or tawny, short, very unequal; achenia turbinate, villous. *Porter and Coulter's Flora of Colorado.*

‡GRINDELIA, Willd. Heads many-flowered; the ray-flowers generally present, pistillate, the ligule elongated; disk-flowers perfect, the corolla tubular-funnel-shaped, 5-toothed. Involucre subglobose or hemispherical, the scales imbricated in many rows, often with squarrose tips. Receptacle naked, flat, foveolate. Style with lanceolate hispid appendages as long as the stigmatic portion. Achenium smooth, oblong or ovate somewhat angled. Pappus of 2 to 8 smooth rigid deciduous awns, shorter than the disk-corollas.—Biennial (?), perennial or suffruticose, often resiniferous, Mexican and North American plants. Leaves entire or serrate, often punctate, the cauline ones sessile. Heads corymbed at the ends of the branches, or solitary, mostly rather large.

G. SQUARROSA, Dunal. Glabrous and viscidly resinous; stems herbaceous from a

CHRYSOPSIS, Nutt. GOLDEN ASTER.

C. villosa, Nutt. Golden Aster.

Common throughout most of the state ; but probably wanting or infrequent near its south side, and also northeastward. Fort Snelling, *Parry;* Minneapolis (common), *Roberts;* upper Mississippi river, *Houghton, Garrison;* common in Stearns and Todd counties and in the Red river valley, *Upham*.

INULA, L. ELECAMPANE.

I. Helenium, L. *Elecampane.*

Nicollet county, *Aiton;* Minneapolis, *Roberts*. Infrequent.

POLYMNIA, L. LEAF-CUP.

P. Canadensis, L. Leaf-cup.

Lapham. Rare. South.

SILPHIUM, L. ROSIN-PLANT.

S. laciniatum, L. Rosin-weed. Compass-Plant.

Common, often abundant, in the south edge of the state ; extending north to Goodhue county, *Sandberg*, southeastern Rice county (plentiful), Nicollet county, *Aiton*, southeastern Watonwan county (frequent), and New Ulm (very scarce), *Juni;* and west to Luverne, *Upham;* and into Dakota, Gray's *Synoptical Flora of N. A.* A gum which is frequently chewed like that of the spruce, exudes from stems of this plant, when their tops are broken off. The peculiar deflection of the leaves to a north and south direction, at the same time presenting one edge upward and the other toward the ground, is very noticeable. (See *American Naturalist*, vol. xvi, pp. 625—635, and vol. xvii, pp. 542 and 656.)

S. terebinthinaceum, Jacq. Prairie Dock. Rosin-Plant.

Lapham. Blue Earth county, *Leiberg*. South.

S. integrifolium, Michx. Rosin-Plant

Lapham. South.

S. perfoliatum, L. Cup-Plant.

Common southward ; extending north to Minneapolis, *Roberts*, the Minnesota river (common), Fergus Falls, *Leonard*, and the Sisseton Agency in Dakota, *Upham*.

PARTHENIUM, L. PARTHENIUM.

P. integrifolium, L. Parthenium.

Lapham. South.

IVA, L. MARSH ELDER. IVA.

I. xanthiifolia, Nutt. (Cyclachæna xanthiifolia, Fres.) Iva.

Frequent southeastward ; abundant southwestward ; extending north to Todd

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perennial caudex, 12 to 20 inches high, corymbosely branched above ; leaves somewhat rigid, glaucous and punctate-reticulated ; the radical ones spatulate-lanceolate, narrowed into a petiole, dentate or incised ; the cauline mostly oblong, sessile and partly clasping, finely toothed or spinulose-serrate ; heads [yellow] numerous ; involucels sub-globose, 6 lines broad; the scales very rigid, closely appressed, but with very long reflexed or squarrose subulate points ; rays numerous, rather narrow ; pappus of 2 to 4 very rigid deciduous bristles or awns. August. *Eaton* in *Bot. Rep. of King's Expl. of the Fortieth Parallel*.

county (common), and in the Red river valley to Grand Forks, *Upham*, and Saint Vincent, *Scott, Havard*. "A new weed that is steadily gaining ground, traveling eastward and possibly southward. It is a candidate for the same situations the large ragweed prefers—the edges of fields, and along roadsides and streets, but especially about barns. If circumstances are unfavorable, it can blossom when only a few inches high, while under more fortunate conditions it reaches much above one's head. It closely resembles cocklebur when young, but as it grows larger has more the appearance of the common sunflower, with flowers, however, after the pattern of the ragweed." *Arthur*.

AMBROSIA, Tourn. RAGWEED.

A. trifida, L. Great Ragweed.

Abundance and range nearly like the last; a similarly vile weed.

A. trifida, L., var. **integrifolia**, Torr. & Gray. Smaller Ragweed.

Hennepin county, *Herrick;* Blue Earth county, *Leiberg*.

A. artemisiæfolia, L. Roman Wormwood. Hog-weed. Bitter-weed.

Common or frequent, through the south half of the state; extending northwesterly to Pembina in the Red river valley, *Havard*, and to the Saskatchewan river.

A. psilostachya, DC. Western Ragweed.

Frequent through the south half of the state; common in the Red river valley; also found at the lake of the Woods, *Dawson*.

XANTHIUM, Tourn. COCKLEBUR. CLOTBUR.

X. Canadense, Mill. (X. strumarium, in *Manual*.) Common Cocklebur.

Frequent, or common, through the south half of the state; extending north to the northwest side of Mille Lacs (common), and the Red river valley; found at the lake of the Woods, *Dawson*. (A variety of this species, having no pubescence between the prickles of the fruit, is common, occurring in company with the ordinary type, in Blue Earth county and along the Minnesota river. *Leiberg*.)

X. Canadense, Mill., var. **echinatum**, Gray. Cocklebur.

Banks of Spirit lake, and head-waters of Little Sioux river, *Geyer;* banks of the Red river (abundant), *Dawson, Scott;* and on the shore of lake Superior.

HELIOPSIS, Pers. OX-EYE. FALSE SUNFLOWER.

H. lævis, Pers. Ox-eye. False Sunflower.

North of lake Superior (common), *Juni, Roberts*; upper Mississippi river, *Garrison;* Pembina, *Chickering*. Perhaps these references should be placed instead under the following species, which certainly is the prevailing representative of the genus in this state.

H. scabra, Dunal.* (H. lævis, Pers., var. scabra, Torr. & Gray.) Ox-eye. False Sunflower.

Red river prairie, *Dawson, Scott, Havard;* Todd county, also Minneapolis and Steele county (common), *Upham;* Stearns county, *Garrison;* Anoka county and New Ulm, *Juni;* Martin county and Emmet county, Iowa (abundant), *Cratty;* Blue Earth county, *Gedge*

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* HELIOPSIS SCABRA, Dunal. Hispidulous-scabrous, especially the leaves, 2 to 4 feet high: leaves from broadly ovate and subcordate to ovate-lanceolate, the upper occasionally entire: rays oblong, nearly or quite an inch in length: akenes smooth, but the angles above pubescent when young, the summit usually bearing an obscure or evident and irregular coroniform chaffy pappus, or sometimes 2 or 3 conspicuous and rigid teeth! Otherwise as the foregoing, into which it may pass. *Gray's Synoptical Flora of N. A.*

E. angustifolia, DC. Narrow-leaved Purple Cone-flower.

Abundant south and southwest; extending north to Anoka county, *Juni*, Stearn county, *Campbell*, Grant county, *Roberts*, and Clay county (common), *Upham*. (Th club-shaped stems, six to nine inches high, remain standing through the winter.)

RUDBECKIA, L. CONE-FLOWER.

R. laciniata, L. Cone-flower.

Common, or frequent, through the south half of the state and in the Red river valley; on Roseau river, *Dawson*.

R. subtomentosa, Pursh. Cone-flower.

Lapham. Stearns county, *Garrison*. Southeast.

R. hirta, L. Cone-flower.

Common, occasionally abundant, throughout the state, excepting perhaps northeastward.

LEPACHYS, Raf. LEPACHYS.

L. pinnata, Torr. & Gray. Lepachys.

Frequent, in some places abundant, southward; extending north to Minneapoli (common) *Roberts*, Stearns county, *Campbell*, and in the Red river valley to Cla county (common), *Upham*, and Pembina, *Havard*.

L. columnaris, Torr. & Gray.* Lepachys.

Upper Minnesota river, *Geyer;* near Moorhead, *Leiberg*, and Glyndon, Clay county *Gedge;* Pembina, *Scott*. West.

HELIANTHUS, L. SUNFLOWER.

H. petiolaris, Nutt.† Sunflower.

Dunes at Sand Hill river, Garfield, Polk county (lanceolate leaves, opposite on lowe half of the stem; rays about 12, one to one and a half inches long; disk dark-purple *Upham*. West.

H. annuus, L.‡ (H. lenticularis, Dougl.) Sunflower.

Frequent in the Red river valley; Saint Vincent, Grand Forks, and Norman county *Upham*. West. (Indigenous throughout the western half of the United States referred to H. annuus, L., the cultivated sunflower, as its original and typical form, b Gray in the *Botany of California* and *American Journal of Science*, series 3, xxv, 24 "Gigantesque forms everywhere commonly cultivated," and occasionally adventive.)

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*LEPACHYS COLUMNARIS, Torr. & Gray. Strigose-scabrous, branched from th base, 1 to 2 feet high; radical leaves usually undivided, spatulate-lanceolate, caulin ones pinnately parted, the upper sessile, segments linear-lanceolate or oblong, rigi mucronulate, entire, rarely somewhat lobed; disk columnar, longer than the 5 to 8 ol long or obovate-oval, recurved, yellow rays; chaff with woolly tips. Disk 1 inch more long. *Porter and Coulter's Flora of Colorado.*

†HELIANTHUS PETIOLARIS, Nutt. Stem erect, 1 to 3 feet high, strigose or hispi branching; leaves scabrous, alternate, the lower sometimes opposite, ovate-lanceolat or ovate, entire or somewhat repand-toothed, 3-nerved, on very long, slender, scabrou petioles; peduncles terminal, naked, bearing solitary (usually large) heads; scales the involucre lanceolate, acute or acuminate; disk-flowers pubescent at base; achen villous; pappus of two chaffy awns. Heads very variable in size. *Porter and Coulter Flora of Colorado.*

‡See description of HELIANTHUS ANNUUS, L., on next page.

H. rigidus, Desf. Sunflower.

Common through the south half of the state and in the Red river valley; one to three feet high on the natural prairie; persisting as a troublesome weed in wheat-fields during the first two or three years of cultivation, there growing from three to five feet in hight.

H. lætiflorus, Pers. Sunflower.

Martin county, *Gedge;* Blue Earth county, *Leiberg;* Redwood, Todd (common), Wadena and Polk counties, *Upham;* Pembina, *Havard.* South and west.

H. occidentalis, Riddell. Sunflower.

St. Croix river, *Parry;* plentiful near lake Johanna, Ramsey county, *Roberts, Herrick;* lake Pepin, *Miss Manning.* Infrequent. Southeast.

H. Maximiliani, Schrader.* Sunflower.

Common in the south half of the state; reaching eastward at least to Minneapolis, where it is plentiful; also abundant in the Red river valley; extending northwest to the Saskatchewan river (Gray's *Synoptical Flora of N. A.*). Usually from nine to eighteen inches high, or sometimes three to five feet, on the natural prairie; but continuing as the most troublesome weed in wheat-fields, where it commonly grows four to six feet in hight and sometimes eight feet or more; foliage dull, grayish green; flowers showy, occasionally double (with all the corollas ligulate), blooming from July to September. The most noteworthy member of this genus in Minnesota. West and south.

Determined by *Prof. Asa Gray;* previously supposed, by the local botanists of the state, to be H. giganteus, L.; in Dr. Lapham's catalogue, it appears to be called H. tomentosus, Michx.; to *R. I. Cratty* and *J. C. Arthur* belongs the credit of obtaining its correct identification. (See Arthur's *Contributions to the Flora of Iowa*, No. V, and his note respecting this species in the *Botanical Gazette*, viii, p. 339. Dr. George Engelmann wrote me, Dec. 27, 1883: "The notice in the *Botanical Gazette* about Helianthus Maximiliani, wondering that it was found so far north, in Minnesota, is founded on error. The species comes originally from the upper Missouri, latitude of Minnesota, and has often been collected in Minnesota also by me; but extends, like many prairie plants, through many degrees of latitude, to Texas.")

H. giganteus, L. Sunflower.

St. Croix river, *Parry;* lake Pepin, *Miss Manning;* Minneapolis, *Twining;* north of lake Superior, *Roberts;* and northwest to the Saskatchewan river, Gray's *Synoptical Flora of N. A.* Infrequent. East and north.

H. grosse-serratus, Martens. Sunflower.

Moist prairies, Minnesota river, *Geyer;* abundant in Martin county and in Emmet county, Iowa, *Cratty;* lake Pepin, *Miss Manning;* moist land, Minneapolis, and Red-

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HELIANTHUS ANNUUS, L. (H. lenticularis, Dougl.) Annual, scabrous and even hispid; stems purple-spotted, stout, 3 to 8 feet high, branching; leaves alternate, ovate, acuminate, coarsely serrate, 3 to 6 inches long, 2 to 4 inches broad, 3-nerved at the base and suddenly narrowed into a petiole nearly as long as the leaf; uppermost leaves more lanceolate; heads mostly panicled, peduncled, 2½ to 4 inches broad; involucre spreading; the numerous ovate ciliate abruptly acuminate scales imbricated in about 3 rows, outer ones shortest; rays 20 to 24 [to 40], large; chaff of the flat receptacle nearly as long as the purplish disk-flowers, concave, carinate, tricuspidate, the middle point much the strongest and dark-colored; achenia finely appressed-pubescent; pappus of two lanceolate chaffy awns. *Eaton* in *Bot. Rep. of King's Expl. of the Fortieth Parallel.*

*HELIANTHUS MAXIMILIANI, Schrad. Stem strigose-scabrous, branched; leaves alternate (those of the branches sometimes opposite), lanceolate, entire or nearly so, tapering to each end, acuminate, very scabrous and often canescent-strigose on both sides, the lower petioled; scales of the involucre lanceolate-subulate, much attenuate, strigose-canescent; pappus of two lanceolate slightly fringed chaffy scales. *Arthur's Contributions to the Flora of Iowa*, No. V, from *Torrey and Gray's Flora of N. A.*

wood, Stearns and Pope counties (common), *Upham;* less frequent, or wanting, in the Red river valley; four to eight feet high; leaves dark green, coarsely toothed, with intervals varying from a quarter to two-thirds of an inch between the teeth. South.

H. strumosus, L. Sunflower.

Through the south half of the state, infrequent. Douglas county, *Mrs. Terry;* New Ulm, *Juni;* Blue Earth county, *Leiberg;* Minneapolis, *Twining, Kassube;* lake Pepin, *Miss Manning.* [The var. mollis, Torr. & Gray, probably also occurs in this state.]

H. divaricatus, L. Sunflower.

Minneapolis, etc. (common), *Roberts;* Saskatchewan river, Gray's *Synoptical Flora of N. A.* South and west.

H. hirsutus, Raf. Sunflower.

Minneapolis, *Twining, Upham;* Worthington, Nobles county (common), *Foote.* South.

H. tracheliifolius, Willd. Sunflower.

Frequent, or common, throughout the state, excepting northeastward. Minneapolis, *Roberts;* lake Pepin, *Miss Manning;* upper Mississippi river, *Garrison;* Pembina, *Havard;* Rice (common), Morrison and Polk counties (often showing forms intermediate between this and the next, partaking of the characters of both), *Upham.*

H. decapetalus, L. Sunflower.

Lapham. Anoka county, also New Ulm (common), *Juni;* Stearns county, etc., *Upham.* [The form called var. frondosus, in Gray's *Manual,* has been observed in Stearns county by *Garrison.*]

H. tuberosus, L. (H. doronicoides, in *Manual.*) Sunflower. (Original of Jerusalem Artichoke.)

Throughout the state. Minnesota and St. Croix rivers, *Parry;* Redwood Falls, *Miss Butler;* New Ulm (common), *Juni;* upper Mississippi river, *Garrison;* common in the valley of the St. Louis river and northeasterly, *Clark;* extending northwest to the Saskatchewan river, Gray's *Synoptical Flora of N. A.*

H. tuberosus, L., var. **subcanescens**, Gray. Sunflower.

Mostly dwarf (about two feet high), comparatively small-leaved, rough-hispidulous or scabrous, but the lower face of the leaves whitish with soft and fine pubescence.—Plains of Minnesota, Dakota, etc., *Kennicott, Coues, Ward,* sometimes with well-developed tubers. Gray's *Synoptical Flora of N. A.*

COREOPSIS, L. TICKSEED.

C. lanceolata, L. Tickseed.

Lapham. Rare. Southeast.

C. tinctoria, Nutt.* Tickseed.

Low ground, Saskatchewan and Minnesota to Louisiana, Texas and Arizona. Gray's *Synoptical Flora of N. A.*

C. palmata, Nutt. Tickseed.

Common through the south half of the state; extending north to the upper Mississippi river, *Houghton, Garrison,* and northwest to Winnipeg, Gray's *Synoptical Flora of N. A.*

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*COREOPSIS TINCTORIA, Nutt. Annual: glabrous, 2 or 3 feet high: leaves opposite; radical and some lower cauline leaves 2-pinnately divided into lanceolate or linear divisions; upper with 3 to 7 linear divisions: outer involucre short and close: rays from half to three-fourths inch long, sometimes base only, sometimes nearly all crimson-brown: akenes oblong, thinnish, moderately incurved, wingless; pappus none or an obscure border. *Gray's Synoptical Flora of N. A.*

C. aristosa, Michx. Tickseed.

Anoka county, *Juni;* peat bogs, Blue Earth county, *Leiberg.* Infrequent. South.

C. trichosperma, Michx. Tickseed Sunflower.

Lapham. Saint Paul, *Kelley.* Southeast.

BIDENS, Tourn. BUR-MARIGOLD.

B. frondosa, L. Common Beggar-ticks. Stick-tight.

Common, or frequent, throughout the state.

B. connata, Muhl. Swamp Beggar-ticks.

Lapham. Blue Earth county, *Leiberg;* Minneapolis, *Roberts.* South.

B. cernua, L. Smaller Bur-Marigold.

Common north of lake Superior, *Roberts,* and at Glenwood, Pope county, *Upham;* Stearns county, *Campbell;* Anoka county, also New Ulm, *Juni;* Ramsey county, *Kelley;* lake Pepin, *Miss Manning;* Nobles county, *Leiberg;* not common southward, nor in the Red river valley.

B. chrysanthemoides, Michx. Larger Bur-Marigold.

Common throughout the state.

B. Beckii, Torr. Water Marigold.

St. Croix river to the sources of the Mississippi, *Houghton;* lake of the Woods, *Dawson;* Minneapolis (common), *Roberts.* Probably frequent throughout the state.

DYSODIA, Cav. FETID MARIGOLD.

D. chrysanthemoides, Lag. Fetid Marigold.

Nobles county, *Leiberg.* Infrequent. South.

GAILLARDIA, Fougeroux. GAILLARDIA.

G. aristata, Pursh.* Gaillardia.

Lapham. Red river valley, in Clay county, *Gedge,* Marshall county, *Winchell,* and near Saint Vincent, *Scott.* West.

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*GAILLARDIA, Fougeroux. Heads many-flowered, radiate; rays neutral, deciduous, many-nerved, the apex trifid; disk-flowers perfect, the tube short, the 5-cleft limb hispid with articulate usually colored hairs. Receptacle convex, usually fimbrillate. Involucral scales in two or three series, from a rigid base, running into a leafy appendage longer than the disk. Branches of the style terminated by a long awl-shaped hispid appendage. Achenia oblong or inversely pyramidal, villous. Pappus of 6 to 10 membranous or hyaline scales, the midnerve produced into a slender awn.—North American herbs more or less pubescent or glandular. Leaves alternate, the lower ones petioled and often lobed, the upper sessile and entire. Heads on long naked peduncles. Rays yellow, often saffron-colored or brownish-purple at the base. Disk-flowers yellow or violet. *Bot. Rep. of King's Expl. of the Fortieth Parallel.*

G. ARISTATA, Pursh. Perennial, villous-pubescent or almost tomentose with jointed hairs; stem simple or branched, 1 to 2 feet high; leaves minutely punctate; radical and lower ones lanceolate, tapering into slender petioles, sinuate pinnatifid or coarsely toothed, minutely serrate or nearly entire; the uppermost linear or oblong-lanceolate, sessile, usually dilated at the base and partly clasping; heads large, 1½ to 2½ inches in diameter, including the rays; involucre hirsute; corollas of the disk with short, broadly subulate teeth, of a rich brownish-purple or maroon color; rays 10 to 18, crowded, elongated-cuneiform, deep yellow; chaff of the pappus 6 to 8, broadly lanceolate; fimbrillæ of the receptacle few, aristæform, slender, distinct, not dilated at the base, 2 to 3 times the length of the nearly smooth achenia. *Porter and Coulter's Flora of Colorado.*

G. pinnatifida, Torr. Gaillardia.

Red river prairie, *Dawson*. West (mostly southwest). [Perhaps more correctly referable to the preceding species.]

HELENIUM, L. Sneeze-weed.

H. autumnale, L. Sneeze-weed.

Common through the south half of the state and in the Red river valley; extending northeastward at least to the upper Mississippi river, *Garrison*.

ANTHEMIS, L. Chamomile.

A. Cotula, L. (*Maruta Cotula*, DC.) *May-weed. Dog Fennel.*

A common, often abundant, weed in the southern two-thirds of the state; less frequent in clearings of the forest farther north; also less common westward, and scarce from Ada northward in the Red river valley.

A. nobilis, L. *Garden Chamomile.*

Adventive, Beaver Bay, *Juni*.

ACHILLEA, Vaill. Yarrow.

A. Millefolium, L. Common Yarrow or Milfoil.

Common throughout the state. The following notes describe this species on the north shore of lake Superior: "Abundant all along the shore, forming a fringe of white just on the line between the forest trees and the waves; was not found in other situations." *Juni*.—"The rose-colored variety occurs sparingly, showing all shades of color from white to a quite deep pink." *Roberts*.

CHRYSANTHEMUM, Tourn. Chrysanthemum.

C. Leucanthemum, L. (*Leucanthemum vulgare*, Lam.) *Ox-eye Daisy. White-weed.*

Lake City, *Miss Manning;* Stillwater, *Miss Field;* Mankato, *Prof. Bechdolt;* Minneapolis (frequent), *Roberts;* Saint Cloud, *Campbell;* upper Mississippi river, *Garrison*. Rare or local; inclined to spread; an abundant and pernicious weed in states farther east.

TANACETUM, Tourn. Tansy.

T. vulgare, L. *Common Tansy.*

Adventive: lake Pepin; Goodhue county; Minneapolis; Blue Earth county; Emmet county, Iowa.

T. Huronense, Nutt. Lake Huron Tansy.

Upper Mississippi river, *Garrison*. Infrequent. North.

ARTEMISIA, Tourn. Wormwood.

A. glauca, Pall.† Wormwood.

Saskatchewan and Minnesota, *Drummond, Nicollet, Kennicott*. (*Gray's Synoptical Flora of N. A.*)

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*Gaillardia pinnatifida, Torr. Perennial, canescent; stems 8 to 12 inches high, branching; leaves sessile, pinnatifid, the rachis and remote lobes linear; heads rather small; involucre in about two series, nearly equal to the disk; rays deeply 3-cleft; chaff of the pappus lanceolate; fimbrillæ of the receptacle aristæform, slender, sparse, longer than the achenia. *Porter and Coulter's Flora of Colorado.*—A showy flower; heads 1 to 2 inches broad; rays yellow, or purple toward the base; disk-flowers purplish: leaves 1 to 3 inches long. *Bot. Rep. of King's Expl. of the Fortieth Parallel.*

† See description of Artemisia glauca, Pall., on next page.

A. dracunculoides, Pursh. Wormwood.

Common through the south half of the state, and probably occurring also, but less frequently, in the Red river valley; extending northeast to Crow Wing and Todd counties, *Upham.*

A. borealis, Pallas. Wormwood.

Upper Mississippi river, *Garrison.* North. [Probably the var. WORMSKIOLDII, Bess., which is taller, 10 to 16 inches high, with more numerous heads in looser or compound narrower thyrsus. *Gray's Synoptical Flora of N. A.*]

A. Canadensis, Michx. Wormwood.

Lake Superior to sources of the Mississippi, *Houghton, Garrison;* lake of the Woods, *Dawson;* Red river valley, *Scott;* White Bear, Ramsey county, *Kelley.* North.

A. caudata, Michx. Wormwood.

Common through the south half of the state; abundant (frequently having galls) in the Red river valley, *Upham.*

A. serrata, Nutt.* Wormwood.

Prairies and low grounds, Illinois to Dakota; first collected by *Nuttall.* (Gray's *Synoptical Flora of N. A.*)

A. longifolia, Nutt.† Wormwood.

Rocky banks, Minnesota and Nebraska to Saskatchewan and Montana; first collected by *Nuttall*, or by *Lewis and Clarke.* (Gray's *Synoptical Flora of N. A.*)

A. Ludoviciana, Nutt. Western Mugwort. "Sage."

The form with incised or subpinnatifid leaves is occasionally found through the south half of the state and in the Red river valley, *Upham.* This is not regarded by Gray's *Synoptical Flora* as distinct from the form with undivided leaves (var. gnaphalodes, in *Manual*), which has been noted as follows: Minneapolis, *Roberts;* Blue Earth county, *Leiberg;* abundant in Martin county, and in Emmet county, Iowa, *Cratty;* Red river valley (common), *Upham, Scott.* (*Mr. Arthur* states that the first of these forms is infrequent or rare in Iowa; but that the second is common there. Specimens of this species sent by *Prof. Gedge* from Marshall, Lyon county, in rich soil near the Redwood river, have the broadly lanceolate leaves all entire or only sparingly toothed, with their upper surface nearly glabrate and green; as is said by Gray's *Synoptical Flora* to be sometimes their condition.)

A. biennis, Willd. Biennial Wormwood.

Frequent, often common, throughout the state.

A. Absinthium, L. *Common Garden Wormwood.*

Lapham. Blue Earth county, *Leiberg.* Rarely adventive.

ARTEMISIA GLAUCA, Pall. Minutely silky pubescent or canescent, sometimes glabrate and glaucous: stems strict, a foot or two high, somewhat woody at base: leaves rather short, from linear- to oblong-lanceolate, mostly entire, occasionally some 3-cleft, or the lowest even more divided: heads nearly of the next, into which it probably passes. *Gray's Synoptical Flora of N. A.*

*ARTEMISIA SERRATA, Nutt. Stems 6 to 9 feet high, very leafy; leaves green and glabrous above, white-tomentose beneath, lanceolate or uppermost linear, 3 to 7 inches long, all serrate with sharp narrow teeth, pinnately veined, the earliest sometimes pinnately incised: heads amply paniculate, rather few-flowered, less than two lines long, greenish, hardly pubescent. *Gray's Synoptical Flora of N. A.*

†ARTEMISIA LONGIFOLIA, Nutt. Stem 2 to 5 feet high: leaves entire, at first tomentulose, but usually glabrate above, white tomentose beneath, linear or linear-lanceolate (3 to 7 inches long, 1 to 5 lines wide); veins obsolete: heads amply paniculate, usually canescent, 2 to 3 lines long. *Gray's Synoptical Flora of N. A.*

A. frigida, Willd. Wormwood. Sage.

Lake Superior; "rising ground, east of the Red river prairie," *Dawson, Scott;* and southward to Minneapolis (plentiful on the river bluffs below the falls of St. Anthony) and Fort Snelling, lake Pepin, *Miss Manning*, and Pipestone county, *Leiberg, Mrs. Bennett.* Local.

GNAPHALIUM, L. CUDWEED. EVERLASTING.

G. decurrens, Ives. Everlasting.

North shore of lake Superior (Deronda bay and Grand Portage island), *Juni;* Nicollet county, *Gedge.* Infrequent. Northeast.

G. polycephalum, Michx. Common Everlasting.

Throughout the state, but infrequent. Lake Superior, *Whitney;* lake of the Woods, *Dawson;* St. Croix Falls, *Miss Field;* lake Pepin, *Miss Manning;* Blue Earth county, *Leiberg.*

G. uliginosum, L. Low Cudweed.

Lapham. Pipestone county, *Mrs. Bennett.* Infrequent.

ANAPHALIS, DC. EVERLASTING.

A. margaritacea, Benth. & Hook. (Antennaria margaritacea, R. Br.) Pearly Everlasting.

Common at Beaver Bay (north shore of lake Superior), and at Minneapolis, *Roberts;* Wadena county, etc., *Upham;* Blue Earth county, *Leiberg.* Throughout. Local.

ANTENNARIA, Gærtn. EVERLASTING.

A. plantaginifolia, Hook. Plantain-leaved Everlasting.

Common, or abundant, throughout the state.

ERECHTITES, Raf. FIREWEED.

E. hieracifolia, Raf. Fireweed.

Stearns county, *Garrison;* Douglas county, *Mrs. Terry;* falls of the St. Croix, *Parry;* Minneapolis, *Kassube;* lake Pepin, *Miss Manning;* Anoka county, also New Ulm, *Juni;* Blue Earth county (common), *Leiberg.* South.

CACALIA, L. INDIAN PLANTAIN.

C. reniformis, Muhl. Great Indian Plantain.

Fillmore county, *Winchell;* lake Pepin, *Miss Manning;* Hennepin county, *Herrick.* Infrequent. South.

C. atriplicifolia, L. Pale Indian Plantain.

Goodhue county, *Sandberg.* Southeast.

C. tuberosa, Nutt. Tuberous Indian Plantain.

Dakota county (frequent), *Upham;* Steele county, *Miss Bixby;* Blue Earth county, *Leiberg;* New Ulm, *Juni;* common in Martin county and in Emmet county, Iowa, *Cratty.* South.

SENECIO, Tourn. GROUNDSEL.

S. vulgaris, L. *Common Groundsel.*

Mankato (frequent), *Leiberg;* Saint Paul, *Kelley.*

S. palustris, Hook. Groundsel.

Common, or frequent, through the northernand central portions of the state;

extending eastward at least to the St. Louis river, *Mrs. Herrick*, Morrison county and Minneapolis, *Upham*, Goodhue county, *Sandberg*, and lake Pepin, *Miss Manning;* abundant about lakes in Grant county, *Roberts*, and in swamps near New Ulm, *Juni;* very rare in Emmet county, Iowa, *Cratty*.

S. integerrimus, Nutt.* Groundsel.

Lapham. West.

S. aureus, L. Golden Ragwort. Squaw-weed. Life-root.

Common, or frequent, throughout the state, in some portions abundant.

S. aureus, L., var. **obovatus**, Torr. & Gray. Golden Ragwort. Squaw-weed.

Minneapolis, *Kassube*; Pipestone county, *Mrs. Bennett;* and perhaps throughout the state.

S. aureus, L., var. **Balsamitæ**, Torr. & Gray. Golden Ragwort. Squaw-weed.

Throughout the state. North of lake Superior, *Agassiz*; Pembina, *Chickering;* Pokegama Falls, *Houghton*; Minneapolis, *Roberts*.

S. canus, Hook.† Groundsel.

Put in bay, north shore of lake Superior, *Juni*. North.

S. lugens, Richardson.‡ (Including var. Hookeri, Eaton.) Groundsel.

Red river valley near Moorhead, *Leiberg;* Pipestone county, *Mrs. Bennett*. [Also Plymouth county, in northwestern Iowa, *Arthur*.] West.

ARNICA, L. ARNICA.

A. Chamissonis, Less. (A. mollis, Hook.) Arnica

North shore of lake Superior, *Juni*. North.

CENTAUREA, L. STAR THISTLE.

C. Cyanus, L. *Blue-bottle. Bachelor's-Button.*

Escaped from gardens, Blue Earth county, *Leiberg*.

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*SENECIO INTEGERRIMUS, Nutt. Glabrous throughout; stem simple, striate, 12 to 18 inches high; leaves entire; radical ones 3 to 5 inches long and 1 to 2 inches wide, rather obtuse, tapering into a petiole, somewhat fleshy, upper small, lanceolate, acute, partly clasping; corymb simple or nearly so; heads rather large, 8 to 20; involucre hemispherical, bracteolate, scales 15 to 20, narrowly linear, acute; rays about 8, small; disk-flowers 40 to 50; achenia striate, nearly glabrous. *Porter and Coulter's Flora of Colorado.*

†SENECIO CANUS, Hook. Whitish tomentose throughout; stems tufted, 2 to 12 inches high; radical leaves obovate, obtuse, narrowed into short petioles; the cauline sessile, lanceolate, pinnately cleft, or with a few teeth near the base, rarely entire; heads rather large, few in a simple corymb; involucre nearly ecalyculate; rays 8 to 12, not twice as long as the involucre; achenia glabrous. *Eaton* in *Bot. Rep. of King's Expl. of the Fortieth Parallel.*

‡SENECIO LUGENS, Richardson. Lightly floccose-woolly when young, in the typical form early glabrate and bright green: stem 6 inches to 2 feet high, few- and small-leaved and naked above, terminated by a cyme of several or rather numerous heads (these about five lines high): radical and lower cauline leaves spatulate, varying to oval or oblong, either gradually or abruptly contracted at base into a winged or margined short petiole, usually repand- or callous-denticulate; upper cauline lanceolate or reduced and bract-like; bracts of the campanulate involucre lanceolate, with obtuse or acutish commonly blackish-sphacelate tips: heads many-flowered: rays 10 or 12, conspicuous. *Gray's Synoptical Flora of N. A.*

CNICUS, Tourn. (Included in CIRSIUM by *Manual.*) THISTLE.

C. lanceolatus, Hoffm. *Common Thistle.*

Frequent, but seldom plentiful, throughout the state. North of lake Superior, *Juni;* Pembina, *Havard;* Minneapolis, *Griswold, Kassube;* lake Pepin, *Miss Manning;* Wabasha, *Gibson;* Nicollet county, *Aiton;* Blue Earth county and southward (common), *Leiberg.*

C. Pitcheri, Torr. Pitcher's Thistle.

North shore of lake Superior, *Macoun;* doubtless in Minnesota.

C. undulatus, Gray. Thistle.

North of lake Superior (in a grass field at Grand Marais, said to have made its first appearance in 1878), *Roberts.* [Near Fort Pierre, Dakota, *Geyer.*] Plains, &c., from lake Huron and Minnesota to Saskatchewan, west to Oregon, south to Kansas and New Mexico. *Gray's Synoptical Flora of N. A.*

C. undulatus, Gray, var. **canescens,** Gray. Thistle.

Merely a form with smaller heads, sometimes not over an inch long, the leaves varying from ciliately spinulose-dentate to deeply pinnatifid.—Minnesota to New Mexico and southern Utah. *Gray's Synoptical Flora of N. A.*

C. undulatus, Gray, var. **megacephalus,** Gray. Thistle.

Stouter form, usually broader-leaved, with broad heads 2 inches or more long.—Minnesota and Texas to Idaho. *Gray's Synoptical Flora of N. A.*

C. altissimus, Willd. Tall Thistle.

Lake Pepin, *Miss Manning;* Minneapolis, *Simmons;* Faribault, *Miss Beane;* Blue Earth county, *Leiberg;* abundant in Martin county, and in Emmet county, Iowa, *Cratty;* common northwestward and in the Red river valley, *Upham, Scott.* South and west.

C. altissimus, Willd., var. **discolor,** Gray. (C. discolor, Muhl.) Thistle.

Minneapolis, *Kassube, Roberts, Simmons;* Hesper, Iowa (common), *Mrs. Carter;* Worthington (common), *Foote;* Redwood Falls, *Pemberton;* Anoka county, *Juni;* Stearns county, *Garrison;* Clay county, *Upham;* Pembina, *Havard.* South and west.

C. muticus, Pursh. Swamp Thistle.

Common, or frequent, throughout the state.

C. pumilus, Torr. Pasture Thistle.

Goodhue county, *Sandberg;* Dakota county (frequent), *Upham;* Anoka county, *Juni;* Stearns county, *Garrison;* Alexandria, Douglas county, *Mrs. Terry.* South.

C. arvensis, Hoffm. *Canada Thistle.*

Newburgh, Fillmore county, *Mrs. Carter;* covering about an acre close west of Rochester, Olmsted county; a few miles east of Faribault; Stillwater, *Miss Field;* on Western avenue, at the west border of Minneapolis, spreading, *Roberts.* Rare, but likely to become common; in many districts farther east, "a most troublesome weed, extremely difficult to eradicate."

ONOPORDON, Vaill. COTTON THISTLE. SCOTCH THISTLE.

O. acanthium, L *Cotton Thistle. Scotch Thistle.*

Lake City, *Mrs. Ray.* Rare.

ARCTIUM, L. (LAPPA, Tourn.) BURDOCK.

A. Lappa, L. (*L. officinalis*, Allioni, var. *major*, Gray.) *Common Burdock.*

Common through the south half of the state, and probably northeastward; less frequent in the Red river valley.

CICHORIUM, Tourn. SUCCORY. CHICORY.

C. Intybus, L. *Succory. Chicory.*

Minneapolis, *Herrick*; near Excelsior, Hennepin county, *Mrs. Terry*. Rare.

KRIGIA, Schreber. (Including CYNTHIA, Don.) KRIGIA.

K. Virginica, Willd. Dwarf Dandelion.

Upper Mississippi river, *Garrison*. Rare.

K. amplexicaulis, Nutt. (Cynthia Virginica, Don.) Cynthia.

Common, or frequent, through the south half of the state ; extending north at least to Morrison county (common), *Upham*, and the upper Mississippi river *Garrison*.

TROXIMON, Nutt. TROXIMON.

T. cuspidatum, Pursh. Troximon.

Common, or frequent, through the south and west portions of the state ; extending northeast to lake Pepin, *Miss Manning*, Minneapolis, *Twining*, *Roberts*, Stearns county, *Campbell*, and Pembina, *Chickering*.

T. glaucum, Nutt.* Troximon.

Red river prairie, *Dawson*, *Havard;* near Glyndon, *Leiberg*, *Gedge;* Kittson, Stevens and Lincoln counties, *Upham*. West. [T. aurantiacum, Hook., has been reported, but probably erroneously, at Pembina.]

TRAGOPOGON, L. GOAT'S-BEARD. VEGETABLE OYSTER.

T. pratensis, L.† *Yellow Goat's-Beard.*

Naturalized in meadow of Spring creek near Red Wing, *Sandberg*.

HIERACIUM, Tourn. HAWKWEED.

H. umbellatum, L.‡ Hawkweed.

North shore of lake Superior to the Rocky mountains and northward, Gray's *Synoptical Flora of N. A.*; probably in northern Minnesota.

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* TROXIMON GLAUCUM, Nutt. Usually a foot or two high, rather stout, pale or glaucous, either glabrous or with loose pubescence : leaves linear to lanceolate, from entire to sparingly dentate or sometimes laciniate, 4 to 12 inches long : involucre commonly an inch high and many-flowered; its bracts lanceolate or broader: outer series shorter, often pubescent, or even villous : akenes with apex tapering gradually into a rather stout and nerved beak which is shorter than the body ; akenes with the beak 5 or 6 lines long, longer than the pappus, the copious and rather rigid bristles of which are (as in most species) only denticulate-scabrous. *Gray's Synoptical Flora of N. A.*

†TRAGOPOGON, L. Involucre simple, of many leaves ; receptacle naked ; pappus plumous, achenia longitudinally striate, contracted into a long, filiform beak. Biennial European herbs, with long, linear, grass-like leaves. *Wood's Class-Book.*

T. pratensis, L. Leaves linear, those of the stem dilated at the base and abruptly acuminated into a slender point towards the apex, glabrous. Peduncles scarcely thickened beneath the anthodes [heads]. Florets yellow. Achenes with the beak about as long as the achene, ribbed ; those of the outer florets usually muricated on the ribs. Pappus of all the florets of plumose hairs. *Sowerby's English Botany*, vol. v.

‡HIERACIUM UMBELLATUM, L. Stem a foot or two high, strict, leafy to the top, bearing a few somewhat umbellately disposed heads : leaves narrowly or sometimes broadly lanceolate, nearly entire, sparsely denticulate, occasionally laciniate-dentate, all narrow at base ; the cauline leaves all closely sessile : involucre half inch high, or sometimes smaller, usually livid, glabrous or nearly so : outermost bracts loose or spreading. *Gray's Synoptical Flora of N. A.*

H. Canadense, Michx. Canada Hawkweed.

Common, or frequent, throughout the state; abundant north of lake Superior, *Roberts.*

H. scabrum, Michx. Rough Hawkweed.

St. Croix river, *Parry;* Saint Cloud, *Campbell;* Beaver Bay, *Roberts;* Pembina, *Chickering.* (A hawkweed agreeing with Gray's description of this species in bearing 40- to 50-flowered heads, but in other characters like H. paniculatum, grows in the Red river valley on moist prairie, *Upham.*)

H. longipilum, Torr. Long-bearded Hawkweed.

St. Croix river, *Parry;* Blue Earth county, *Leiberg.* Rare. South.

H. venosum, L. Rattlesnake-weed.

Red river prairie, *Dawson, Scott.* Infrequent.

PRENANTHES, Vaill. (Including NABALUS, Cass.) RATTLESNAKE-ROOT.

P. alba, L. White Lettuce. Rattlesnake-root.

Common throughout the state.

P. serpentaria, Pursh.[*] (N. albus, Hook, var. serpentaria, Gray.) Rattlesnake-root.

Hennepin county, *Herrick;* Stearns county, *Campbell.* [Devil's lake, Dakota, *Geyer.*]

P. altissima, L. Tall White Lettuce.

Between lake Superior and the lake of the Woods, *Macoun.*

P. racemosa, Michx. Rattlesnake-root.

Frequent, or common, throughout the state.

P. aspera, Michx. Rattlesnake-root.

Frequent through the south half of the state; extending north to Stearns county, *Campbell,* and Douglas county, *Mrs. Terry.*

P. crepidinea, Michx. Rattlesnake-root.

Lake Benton, Lincoln county, *Upham.* Infrequent. South.

LYGODESMIA, Don. LYGODESMIA.

L. juncea, Don. Lygodesmia.

Common southwestward, on sandy land; extending north and east to Muskoda, Clay county, and Sand Hill river, *Upham,* Pembina, *Havard,* Meeker county, *Campbell,* Minneapolis, *Roberts,* St. Croix river, *Swezey,* and Blue Earth county, *Leiberg.*

[Crepis runcinata, Torr. & Gray, whose eastern limit extends from the Saskatchewan region to Nebraska and Iowa (*Arthur*), and the nearly related C. glauca, Torr. & Gray, of similar range, seem likely to be found in western Minnesota.]

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[*] PRENANTHES SERPENTARIA, Pursh. Commonly 2 feet high, glabrous or a little hirsute-pubescent: stem sometimes purple-spotted, rather stout: leaves diversely variable, assuming all the forms of the preceding species: inflorescence corymbosely thyrsoid-paniculate; the heads mostly glomerate at summit of ascending or spreading flowering-branches or peduncles: involucre green, rarely purplish-tinged, 8- to 12-flowered; flowers purplish, greenish white or ochroleucous: pappus sordid straw-color or whitish. . . . Open grounds, commonly in sandy or sterile soil. *Gray's Synoptical Flora of N. A*

TARAXACUM, Haller. DANDELION.

T. officinale, Weber. (T. Dens-leonis, Desf.) Common Dandelion.

Common, often abundant, throughout most of the state ; but less frequent near its west side. It seems to be quite absent from some districts westward, as Cottonwood county, *Holzinger;* and occurs rarely in the Red river valley near Saint Vincent, *Dawson, Havard.*

LACTUCA, Tourn. (Including MULGEDIUM, Cass.) LETTUCE.

L. Canadensis, L. Wild Lettuce.

Frequent throughout the state.

L. hirsuta, Muhl. (L. Canadensis, L., var. sanguinea, Torr. & Gray.) Wild Lettuce.

Minneapolis, *Roberts, Upham;* frequent in Martin county and in Emmet county, Iowa, *Cratty.* South.

L. pulchella, DC. (Mulgedium pulchellum, Nutt.) False or Blue Lettuce.

Red river valley at Pembina, *Havard*, and near Moorhead, *Leiberg;* lake Carlos, Douglas county, *Mrs. Terry;* Minneapolis, *A. W. Jones;* Lake Benton and Polk county, *Upham.* North and west.

L. Floridana, Gærtn. (M. Floridanum, DC.) False or Blue Lettuce.

Lapham. Winona county, *Holzinger;* Minneapolis, *A. W. Jones.* South.

L. leucophæa, Gray. (M. leucophæum, DC.) False or Blue Lettuce.

North of lake Superior, *Roberts;* lake of the Woods, *Dawson;* Pembina, *Havard;* Blue Earth county, *Leiberg.*

SONCHUS, Tourn. SOW-THISTLE.

S. oleraceus, L. *Common Sow-Thistle.*

Saint Paul, *Kelley;* Minneapolis, *Miss Butler;* Nicollet county, *Aiton;* New Ulm, *Juni.* Infrequent.

S. asper, Vill. *Spiny-leaved Sow-Thistle.*

More frequent than the preceding : observed at Grand Marais and Beaver Bay, on the north shore of lake Superior ; at Minneapolis ; and in Goodhue, Winona, Rice and Blue Earth counties.

S. arvensis, L. *Field Sow-Thistle.*

Anoka county, *Juni.* Infrequent.

LOBELIACEÆ. LOBELIA FAMILY.

LOBELIA, L. LOBELIA.

L. cardinalis, L. Cardinal Flower.

Along the Mississippi river at Wabasha, *Gibson*, lake Pepin, *Miss Manning*, and Saint Paul, *Mrs. Terry*; and the St. Croix river at Marine Mills, Washington county, *Miss Cathcart*, and at St. Croix Falls, *Miss Field.*

L. syphilitica, L. Great Lobelia.

Common, or frequent, through the south half of the state ; extending north to the upper Mississippi river, *Garrison*, and the Red river valley, *Gedge.*

L. inflata, L. Indian Tobacco.

Lake St. Croix, *Parry;* St. Croix Falls, *Miss Field;* Blue Earth county, *Leiberg.* Infrequent.

L. spicata, Lam. Spiked Lobelia.

Common through the south half of the state and in the Red river valley; extending northeast to the upper Mississippi, *Houghton*.

L. Kalmii, L. Kalm's Lobelia.

Common through the north half of the state and south to Minneapolis, *Roberts*. Common also southward, as in peat bogs in the Minnesota valley between Kasota and Mankato, *Leiberg*;

L. Dortmanna, L. Water Lobelia.

Isle Royale, Dr. A. B. *Lapham*; doubtless in Minnesota north of lake Superior.

CAMPANULACEÆ. Campanula Family.

CAMPANULA, Tourn. Bellflower.

C. rotundifolia, L. Harebell. Bluebell.

Common throughout the state. A very pretty flower, plentiful in all our prairie region and along the shore of lake Superior, in the latter situation varying through intermediate forms to the var. linifolia of Gray's Manual, *Roberts*.

C. aparinoides, Pursh. Marsh Bellflower.

Common throughout the state. In the vicinity of Mankato, a bellflower is reported by *Leiberg* as common in bogs, agreeing well with the description of this species, except in the large size of the flowers, which have the corolla ⅓ to ½ of an inch long, five times as long as the small calyx-lobes. The ordinary smaller-flowered form of this species has not been observed there. The large-flowered form has also been collected at Minneapolis;

C. Americana, L. Tall Bellflower.

Frequent through the south part of the state; extending north to Douglas county, *Mrs. Terry*.

SPECULARIA, Heister. Venus's Looking-Glass.

S. perfoliata, A. DC. Venus's Looking-Glass.

Lapham. Minneapolis, *Kassube*; near Saint Paul, *Mrs. Terry*. Infrequent. South.

ERICACEÆ. Heath Family.

GAYLUSSACIA, HBK. Huckleberry. Whortleberry.

G. resinosa, Torr. & Gray. Common Black Huckleberry.

Frequent, often common, northeastward; extending west to Cass lake, *Schoolcraft*, and south to the falls of Kettle river, in section 15, T. 42, R. 20, *Upham*.

VACCINIUM, L. Cranberry. Blueberry. Bilberry.

V. Oxycoccus, L. Small Cranberry.

Common northward; extending west to the upper Mississippi river, *Garrison*, Becker county, *Gedge*, and Fergus Falls, *Leonard*; and south to Anoka county (plentiful), *Roberts*, and White Bear lake, Ramsey county, *Kelley*.

V. macrocarpon, Ait. Large American Cranberry.

Common through the north half of the state, excepting the Red river valley and near the shore of lake Superior; extending south to Fergus Falls, *Leonard*, and Minneapolis, *Roberts*. Much gathered for the market, especially by the Chippewa Indians.

V. Vitis-Idæa, L. Cowberry.

North shore of lake Superior (swamps at Port Arthur), *Macoun;* doubtless in Minnesota.

V. stamineum, L. Deerberry. Squaw Huckleberry.

Near Saint Paul, *Mrs. Terry.* Rare.

V. uliginosum, L. Bog Bilberry.

North of lake Superior, *Juni.* North.

V. cæspitosum, Michx., var. **cuneifolium,** Nutt. Bilberry.

Margins of a lake near Stillwater, *Parry.* Rare. North.

[V. ovalifolium, Smith, and V. myrtilloides, Hook., will doubtless be found in Minnesota north of lake Superior.]

V. Pennsylvanicum, Lam. Dwarf or Low Blueberry.

Common in the north half of the state ; extending south to Minneapolis, *Roberts,* and lake Pepin, *Miss Manning,* the Mississippi river being its southwestern limit from Minneapolis to Morrison county, *Upham.*

V. Canadense, Kalm. Canada Blueberry.

Falls of the St. Croix river, *Parry;* Stearns county, *Garrison;* and northward.

V. corymbosum, L. Swamp or High Blueberry.

Lapham. Ramsey county (var. amœnum, Gray), *Winchell;* White Earth reservation, *Garrison.* Rare.

CHIOGENES, Salisb. CREEPING SNOWBERRY.

C. hispidula, Torr. & Gray. Creeping Snowberry.

Frequent northeastward ; extending south to Anoka county (plentiful in tamarack swamps), *Roberts;* Hennepin county, *Simmons.*

ARCTOSTAPHYLOS, Adans. BEARBERRY.

A. Uva-ursi, Spreng. Bearberry. Kinnikinnick.

Common, often abundant, on sandy land through the north half of the state ; extending south to Isanti and Sherburne counties (common), *Upham;* rare and local farther south, as in Goodhue county, *Sandberg,* at lake Pepin, *Miss Manning,* and on sandy knolls in section 12, Saratoga, Winona county, *Winchell.*

EPIGÆA, L. MAYFLOWER. TRAILING ARBUTUS. GROUND LAUREL.

E. repens, L. Mayflower. Trailing Arbutus. Ground Laurel.

Minnesota Point and elsewhere near Duluth, *Juni, Miss Cathcart;* falls of Kettle river, *Upham.* Infrequent. Northeast.

GAULTHERIA, Kalm. AROMATIC WINTERGREEN.

G. procumbens, L. Aromatic Wintergreen. Checkerberry.

Common northeastward ; extending west and south to Rainy Lake river, *Keating,* the lake of the Woods, *Dawson,* Wadena county, *Upham,* and Anoka county, *Roberts,* rare farther southeast, as at lake Pepin, *Miss Manning,* and Mound Prairie, Houston county, *Winchell.*

CASSANDRA, Don. LEATHER-LEAF.

C. calyculata, Don. Leather-Leaf.

North of lake Superior (common), *Roberts;* lake of the Woods, *Dawson;* St. Croix river, *Parry;* extending south to Wadena (frequent) and Chisago counties, *Upham,* Minneapolis, *Kassube,* and Stillwater, *Miss Field.*

CASSIOPE, Don. Cassiope.

C. hypnoides, Don. Cassiope.

Minnesota Point, lake Superior, *Miss Cathcart*. Rare. North.

ANDROMEDA, L. Andromeda.

A. polifolia, L. Wild Rosemary.

Plentiful near Grand Marais, and in swamps near lake Johanna, Ramsey county, *Roberts;* Minnesota Point, *Miss Cathcart;* lake of the Woods, and thence toward Red river, *Dawson;* St. Croix river, *Parry;* Chisago county, etc., *Upham;* near Minneapolis, *Kassube*. North.

KALMIA, L. American Laurel.

K. glauca, Ait. Pale Laurel.

Certainly to be found in northern Minnesota, *Macoun*.

MENZIESIA, Smith. Menziesia.

M. glabella, Gray.* Menziesia.

Minnesota Point, lake Superior, *Miss Cathcart*. (The *Botany of California* states that this [called M. ferruginea] extends east "nearly to the upper Great lakes.") Rare. Northwest.

LEDUM, L. Labrador Tea.

L. latifolium, Ait. Labrador Tea.

Common, often abundant, through the north half of the state ; extending south to Sherburne and Anoka counties (common), *Roberts*, and near Saint Paul, *Mrs. Terry*. Used as tea by the Chippewa Indians.

PYROLA, Tourn. Wintergreen. Shin-leaf. Pyrola.

P. rotundifolia, L. Wintergreen. Shin-leaf.

Common through the north half of the state ; extending south to Minneapolis (common), *Roberts*, and rare farther south, as at Cannon River Falls, *Blake, Sandberg*, and Chatfield, Fillmore county, *Winchell*.

P. rotundifolia, L., var. **incarnata**, DC. Wintergreen.

Detroit, Becker county, *Gedge*. North.

P. rotundifolia, L., var. **asarifolia**, Hook. Wintergreen.

St. Croix Falls, *Miss Field;* Saint Cloud, *Garrison*. [Lake Superior, *Whitney*.] North.

P. rotundifolia, L., var. **uliginosa**, Gray. Wintergreen.

Minneapolis (frequent), *Roberts, Winchell;* Morrison county (on dryish land in woods), *Upham*.

P. elliptica, Nutt. Wintergreen. Shin-leaf.

Common, or frequent, throughout the state.

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* Menziesia glabella, Gray. Strigose-chaffy scales wanting, or very few on young petioles and midrib beneath ; leaves obovate, mostly obtuse, barely mucronate-tipped, glaucescent and glabrous or nearly so beneath (an inch or two long), sprinkled with some small appressed hairs above, the obscurely serrulate margins minutely ciliolate : pedicels naked or somewhat glandular : corolla ovoid-campanulate. *Gray's Synoptical Flora of N. A.*

P. chlorantha, Swartz. Wintergreen. Shin-leaf.

Common, or frequent, through the north half of the state; extending south to Isanti county, *Upham.*

P. secunda, L. Wintergreen. Shin-leaf.

Common northward; extending south to the St. Croix river, *Parry,* Goodhue county, *Sandberg,* lake Pepin, *Miss Manning,* Blue Earth county, *Leiberg,* and Redwood Falls, *Pemberton.*

P. secunda, L., var. **pumila,** Paine. Wintergreen. Shin-leaf.

North of lake Superior, *Juni;* in tamarack swamps near Minneapolis, *Roberts.* Rare. North.

P. minor, L. Wintergreen. Shin-leaf.

North of lake Superior (in woods at Kakabeka falls), *Macoun;* doubtless in northern Minnesota.

MONESES, Salisb. MONESES. ONE-FLOWERED PYROLA.

M. uniflora, Gray. One-flowered Pyrola.

North of lake Superior (frequent), *Juni, Roberts;* Becker county, *Gedge;* Stearns county, *Campbell.* North.

CHIMAPHILA, Pursh. PIPSISSEWA. WINTERGREEN.

C. umbellata, Nutt. Prince's Pine. Pipsissewa. Wintergreen.

Frequent northward; extending south to Wadena county, *Upham,* Saint Cloud, *Campbell,* and Anoka county (at Deer lake), *Roberts;* near Minneapolis, *W. H. Hatch;* rare and local farther southeast, as in Goodhue county, *Sandberg,* at lake Pepin, *Miss Manning,* and Hesper, Iowa, *Mrs. Carter.*

C. maculata, Pursh. Spotted Wintergreen.

Clearwater, Wright county, *Mrs. Terry;* Saint Paul, *Miss Cathcart.* Rare.

[Pterospora andromedea, Nutt., will probably be found in northern Minnesota.]

MONOTROPA, L. INDIAN PIPE. PINE-SAP.

M. uniflora, L. Indian Pipe. Corpse-Plant.

Throughout the state: common, occasionally abundant, northward; infrequent or rare southward.

M. Hypopitys, L. Pine-sap. False Beech-drops.

Caribou Point and Carlton's Peak, north of lake Superior, also at Taylor's Falls, *Roberts.* Rare. North.

ILICINEÆ. (AQUIFOLIACEÆ.) HOLLY FAMILY.

ILEX, L. HOLLY.

I. verticillata, Gray. Black Alder. Winterberry.

St. Croix river, *Parry;* lake Pepin, *Miss Manning;* Saint Paul, *Kelley;* Minneapolis, *Winchell;* Stearns county, *Upham;* St. Louis river, *Mrs. Herrick.* North.

NEMOPANTHES, Raf. MOUNTAIN HOLLY.

N. Canadensis, DC. Mountain Holly.

Lapham. St. Croix river, *Parry;* lake Pepin, *Miss Manning.* Infrequent. North.

PLANTAGINACEÆ. PLANTAIN FAMILY.

PLANTAGO, Tourn. PLANTAIN. RIBWORT.

P. major, L. Common Plantain. Wayside Plantain.

Common, often abundant, throughout the state. Evidently indigenous in Rock county, *Leiberg*, and in the Red river valley (where a form occurs, very probably the var. Asiatica, Decaisne, coarser than ordinary, with scape and spike from 1½ to 2 feet high, the spike being 6 to 12 inches long), *Upham*. [Sheyenne river, Dakota, *Geyer*.]

P. Rugelii, Decaisne.* (P. Kamtschatica, Hook.) Plantain.

Blue Earth county (common), *Leiberg;* Martin county, *Cratty*. Perhaps frequent throughout the state, but overlooked on account of its resemblance to the preceding. (Indigenous; found only in America.)

[P. cordata, Lam., should be looked for in the east part of the state ; and *P. lanceolata*, L., may be expected as a weed southeastward.]

P. eriopoda, Torr.† Plantain.

Red river valley, *Watson, Scott*. Northwest.

P. Patagonica, Jacq., var. **gnaphalioides**, Gray. Plantain.

Upper Minnesota river, *Parry;* New Ulm, *Juni*; Nicollet county, *Aiton;* Blue Earth county, *Leiberg;* common in Watab, Benton county, and frequent, often common, thence southwestward, *Upham;* plentiful at the Pipestone quarry (showing gradations in size to small matted plants with almost filiform scapes, none of which exceed two or three inches in hight, bearing few-flowered capitate spikes ⅛ to ¼ inch long), *Mrs. Bennett*. [Devil's lake, Dakota, *Geyer*.] South and west.

PRIMULACEÆ. PRIMROSE FAMILY.

PRIMULA, L. PRIMROSE. COWSLIP.

P. farinosa, L. Bird's-eye Primrose.

North shore of lake Superior, *Whitney, Macoun*; St. Croix lake, Stillwater, *Miss Field*. North.

P. Mistassinica, Michx. Primrose.

Lapham. Abundant on the north shore of lake Superior, *Juni, Roberts*. North.

ANDROSACE, Tourn. ANDROSACE.

A. occidentalis, Pursh. Androsace.

Blue Earth county (common), also a dwarfed form, about an inch high, with solitary flowers, found near South Bend, in this county, *Leiberg;* Pipestone county, *Mrs. Bennett;* Sauk Rapids, *Mrs. Blaisdell;* Walhalla, northeastern Dakota, *Scott.* South and west.

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* PLANTAGO RUGELII, Decaisne. Leaves paler [than in P. major], commonly thinner : spikes long and thin, attenuate at the apex : sepals oblong, all as well as the similar bract acutely carinate : capsules erect in the spike, cylindraceous-oblong (somewhat over 2 lines long, one-sixteenth inch in diameter), about twice the length of the calyx, circumscissile much below the middle: ovules 6 to 10; seeds 4 to 8, oval-oblong (about a line long), opaque and dull brown, not reticulated. *Gray's Synoptical Flora of N. A.*

† PLANTAGO ERIOPODA, Torr. Perennial ; leaves fleshy, broadly lanceolate, 4 to 6 inches long, 1 to 2 inches wide, attenuate at each end, long-petioled, glabrous, entire, 5-nerved ; base of the leaves and scape clothed with long dense brown wool : scape 1 foot high, terete, glabrous or pubescent, with a cylindrical spike (3 to 6 inches long) of rather remote perfect flowers ; bracts scarious-margined, ciliate ; stamens and styles very long ; bracts broadly ovate, mostly obtuse; capsules 4- to 5-seeded ; seeds not hollowed. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*

DODECATHEON, L. AMERICAN COWSLIP.

D. Meadia, L. American Cowslip. Shooting Star. Pride of Ohio.

Lapham. Winona, *Holzinger, Mrs. Terry;* Lake City, *Miss Manning.* Rare. South and west.

TRIENTALIS, L. STAR-FLOWER. CHICKWEED-WINTERGREEN.

T. Americana, Pursh. Star-flower. Chickweed-Wintergreen.

Common through the north half of the state, and south to Minneapolis, *Roberts,* and Saint Paul, *Miss Cathcart;* less frequent farther southeastward, as at lake Pepin, *Miss Manning,* Faribault, *Miss Beane,* and in Blue Earth county, *Leiberg;* absent southwestward.

LYSIMACHIA, Tourn. LOOSESTRIFE.

L. thyrsiflora, L. Tufted Loosestrife.

Frequent throughout the state.

L. stricta, Ait. Loosestrife.

Throughout the state; common northward, and south to Minneapolis; infrequent farther southward.

L. quadrifolia, L. Loosestrife.

Lapham. Dry, sandy ridges, St. Croix river, *Parry;* Lake City, *Mrs. Ray.* Rare. East.

STEIRONEMA, Raf. LOOSESTRIFE.

S. ciliatum, Raf. (Lysimachia ciliata, L.) Loosestrife.

Common, or frequent, throughout the state.

S. lanceolatum, Gray, var. **hybridum,** Gray. (L. lanceolata, Walt., var. hybrida, Gray.) Loosestrife.

Common southward; extending north to Fergus Falls, *Leonard,* and the upper Mississippi river, *Garrison.*

S. longifolium, Gray. (L. longifolia, Pursh.) Loosestrife.

Frequent, often common, in the south half of the state and the Red river valley; extending northeast to the upper Mississippi river, *Garrison.*

GLAUX, Tourn. SEA-MILKWORT.

G. maritima, L. Sea-Milkwort.

Red river prairie (damp places in marshes), *Dawson.* [Between Sheyenne river and Devil's lake, Dakota, *Geyer.*] Northwest.

ANAGALLIS, Tourn. PIMPERNEL.

A. arvensis, L. *Pimpernel.* *"Poor Man's Weather-glass."*

Martin county, *Gedge.* Rare.

CENTUNCULUS, Dill. CHAFFWEED.

C. minimus, L. Chaffweed.

Pipestone quarry, *Mrs. Bennett.* Rare. Southwest.

[Samolus Valerandi, L., var. Americanus, Gray, will probably be found in Minnesota.]

LENTIBULACEÆ. BLADDERWORT FAMILY.

UTRICULARIA, L. BLADDERWORT.

U. vulgaris, L. Greater Bladderwort.

Frequent throughout the state. (It is sometimes nearly or quite destitute of air-bladders in Hennepin and Blue Earth counties.)

U. minor, L. Smaller Bladderwort.

Also frequent throughout the state.

U. intermedia, Hayne. Bladderwort.

Throughout the state, but infrequent. Traverse des Sioux, Minnesota river, *Parry;* Blue Earth county, *Leiberg;* Minneapolis, *Roberts*. [Emmet county, Iowa (rare), *Cratty;* lake Superior, *Whitney*.]

U. cornuta, Michx. Bladderwort.

Isanti and Morrison counties, *Upham*; Minneapolis, *Simmons*.

PINGUICULA, Tourn. BUTTERWORT

P. vulgaris, L. Butterwort.

Common north of lake Superior, *Roberts;* Duluth, *Miss Cathcart*. North.

OROBANCHACEÆ. BROOM-RAPE FAMILY.

APHYLLON, Mitchell. NAKED BROOM-RAPE. CANCER-ROOT.

A. Ludovicianum, Gray. (Phelipæa Ludoviciana, Don.) Broom-rape.

Traverse des Sioux, Nicollet county; "found in a singular isolated locality, rooting on an Indian grave." *Parry*. Rare.

A. uniflorum, Gray. One-flowered Cancer-root.

Minneapolis, *Kassube;* Minnehaha falls. *Roberts;* lake Pepin, *Miss Manning*. [Emmet county, Iowa, *Cratty*; lake Superior, *Whitney*.] Rare.

A. fasciculatum, Gray. Naked Broom-rape. Cancer-root.

Bare granite rocks, upper Minnesota river, *Parry;* Lake City, *Miss Manning*; Hesper, Iowa, *Mrs. Carter*. Rare.

SCROPHULARIACEÆ. FIGWORT FAMILY.

VERBASCUM, L. MULLEIN.

V. Thapsus, L. *Common Mullein*.

Common, or frequent, through the east half of the state; infrequent westward.

V. Blattaria, L. *Moth Mullein*.

Lapham. Lake Pepin, *Miss Manning*. Rare.

LINARIA, Tourn. TOAD-FLAX.

L. Canadensis, Dumont. Wild Toad-Flax.

Plentiful on the prairie about Sandy lake, close north of Minneapolis, *Roberts;* Alexandria, *Mrs. Terry;* upper Mississippi river, *Garrison*. Infrequent.

L. vulgaris, Mill. *Toad-Flax. Butter-and-eggs. Ramsted.*

Becoming a frequent weed, occasionally abundant: upper Mississippi river; Minneapolis; Goodhue, Wabasha, Nicollet and Blue Earth counties.

SCROPHULARIA, Tourn. FIGWORT.

S. nodosa, L., var. **Marilandica**, Gray. Figwort.

Common through the south half of the state; extending north to the upper Mississippi river.

[Collinsia parviflora, Dougl., will probably be found in northern Minnesota.]

CHELONE, L. TURTLE-HEAD. SNAKE-HEAD.

C. glabra, L. Turtle-head. Snake-head. Shell-flower. Balmony.

Common, or frequent, throughout the state, excepting perhaps southwestward.

PENTSTEMON, Mitchell. BEARD TONGUE. PENTSTEMON.

P. pubescens, Solander. Beard-tongue. Pentstemon.

Common, or frequent, through the southeast and central portions of the state and in the Red river valley, extending northeast to the upper Mississippi river, and to the lake of the Woods (rare), *Dawson*; apparently wanting in Blue Earth county and westward, *Leiberg;* but found in Pipestone county, *Mrs. Bennett.*

P. grandiflorus, Nutt. Large-flowered Pentstemon.

Common from lake Pepin, Saint Paul and Minneapolis, to the upper Mississippi river; and thence frequent westerly to Rock county, *Leiberg*, Pipestone county, *Mrs. Bennett*, and the Red river valley near Glyndon, *Gedge.*

P. acuminatus, Dougl.* Beard-tongue. Pentstemon.

Red river, *Watson* in *Bot. Rep. of King's Expl. of the Fortieth Parallel.* West.

MIMULUS, L. MONKEY-FLOWER.

M. ringens, L. Monkey-flower.

Common, or frequent, throughout the state. (In Blue Earth and Martin counties usually having the angles of the stem very decidedly winged, *Gedge;* so, too, at White Bear, Ramsey county, *Miss Field.*)

M. Jamesii, Torr. & Gray. Monkey-flower.

Throughout the state. Minneapolis (plentiful), Fort Snelling, Stillwater, and lake Pepin; Saint Cloud, and the upper Mississippi river; Beaver creek, Rock county, *Leiberg.*

GRATIOLA, L. HEDGE-HYSSOP.

G. Virginiana, L. Hedge-Hyssop.

Frequent, occasionally common, throughout the state. The most northern localities

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*PENTSTEMON ACUMINATUS, Dougl. Glaucous, 6 to 20 inches high, generally stout and rigid, leafy: leaves coriaceous, somewhat cartilaginous-margined; radical and lowest cauline obovate or oblong; upper cauline from lanceolate to broadly ovate, or the upper cordate-clasping, these mostly acute or acuminate: thyrsus strict, interrupted, leafy below, naked above; the clusters several-flowered, and peduncles and pedicels mostly very short: sepals ovate and acute or lanceolate: corolla lilac or changing to violet; the limb half or two-thirds inch in diameter: sterile filament mostly bearded at the dilated tip: capsule firm-coriaceous and acuminate. *Gray's Synoptical Flora of N. A.*

reported are the St. Louis river, *Mrs. Herrick*, and the **Red river** (in an open
Dawson, who mentions also a variety of this species near Saint Vincent.

"A form which seems to be a distinct variety, or perhaps a species hither
scribed, differing much from the ordinary type of G. Virginiana, is reported by
berg, with the following description : "Sterile filaments conspicuously tippe
head ; plant rather robust, 8 to 12 inches high, very smooth when dried, bu
growing state covered with a clammy exudation ; lower leaves lanceolate, enti
(half an inch long) ; upper leaves somewhat clasping, conspicuously 3- to 5-nerv
or broadly lanceolate, acute, mostly sharply toothed, from an inch to one a
inches long ; pedicels mostly longer than the leaves ; bractlets under the ca
lanceolate, entire or slightly toothed, 5 to 6 lines long, 1 to 1½ lines wide, twic
and about three times as wide as the sepals ; corolla yellowish white, a ha
length.—Abundant in peaty bogs, Nicollet county. June."]

ILYSANTHES, Raf. False Pimpernel.

I. gratioloides, Benth. False Pimpernel.

Fort Snelling, *Roberts;* Blue Earth county (common) *Leiberg;* Emmet coun
(rare), *Cratty*. South.

SYNTHYRIS, Benth. Synthyris.

S. Houghtoniana, Benth. Synthyris.

Stillwater, *Parry;* Cannon River Falls, *Blake, Sandberg;* near Saint Paul,
Chisago and Morrison counties (in the latter common north of Little Falls , *U*

VERONICA, L. Speedwell.

V. Virginica, L. Culver's Physic.

Common through the south half of the state and in the Red river valley ; e
northeast to the upper Mississippi river.

V. Anagallis, L. Water Speedwell.

Frequent through the south half of the state and in the Red river valley.

V. Americana, Schwein. American Brooklime.

Frequent throughout the state.

V. scutellata, L. Marsh Speedwell.

Throughout the state, but infrequent. Bogs, upper Mississippi river, *P*
Louis river, *Mrs. Herrick;* Minneapolis, *Juni, Kassube*. [Devil's lake, Dakota

[V. serpyllifolia, L., doubtless occurs in this state, but has been overlooke

V. peregrina, L. Neckweed. Purslane Speedwell.

Frequent, or common, throughout the state.

V. arvensis, L. *Corn Speedwell.*

Duluth, *Juni;* Hesper, Iowa, *Mrs. Carter*. Infrequent.

BUCHNERA, L. Blue-Hearts.

B. Americana, L. Blue-Hearts.

Wabasha, *Gibson*. Rare. Southeast.

GERARDIA, L. Gerardia.

G. purpurea, L. Purple Gerardia.

Common through the south half of the state ; less frequent northward,
Dawson, and in the Red river valley, *Scott, Havard*.

G. purpurea, L., var. **paupercula**, Gray.* Purple Gerardia.

Lower Canada to Saskatchewan, and southward from coast of New England to Penn., N. Illinois and Wisconsin, *Gray's Synoptical Flora of N. A.*; apparently the prevailing form of this species in Minnesota.

G. aspera, Dougl. Purple Gerardia.

Common through the west half of the state, abundant in the Red river valley; extending east to lake Pepin, *Miss Manning*.

G. tenuifolia, Vahl. Slender Gerardia.

Common, or frequent, through the south half of the state; also found in the Red river valley, *Scott*, and at Devil's lake, Dakota, *Geyer*; extending northeast to the upper Mississippi river, *Garrison*.

G. tenuifolia, Vahl., var. **asperula**, Gray.† Slender Gerardia.

Collected by *T. J. Hale*, near the St. Croix river, and in Fillmore county.

G. Skinneriana, Wood. (G. setacea, Gray's *Manual*.) Gerardia.

Lapham. Upper Mississippi river, *Garrison*. Rare. South.

G. quercifolia, Pursh. Smooth False Foxglove.

Lapham. Rare. South.

G. grandiflora, Benth. False Foxglove.

Nicollet county, *Aiton*; Saint Paul, *Miss Cathcart*. South.

G. pedicularia, L. Lousewort Foxglove.

Lapham. Minneapolis, *Roberts*; White Bear lake, Ramsey county, *Kelley*; lake Pepin, *Miss Manning*. Southeast.

G. auriculata, Michx. Gerardia.

Blue Earth county, *Leiberg*; Nicollet county, *Aiton*; New Ulm, *Juni*; frequent in Martin county, and in Emmet county, Iowa, *Cratty*. South.

CASTILLEIA, Mutis. PAINTED-CUP.

C. coccinea, Spreng. Scarlet Painted-Cup. Indian Pink. "Bloody Warrior."

Common, often abundant, throughout the wooded portion of the state; less so in the prairie region; rare from Blue Earth county westward, *Leiberg*. Nearly all yellow, at least in some years, upon districts ten to twenty miles in extent, as was observed in Washington and Ramsey counties; elsewhere scarlet, with occasional yellow specimens intermixed.

C. pallida, Kunth, var. **septentrionalis**, Gray. Pale Painted-Cup.

Lapham. Fergus Falls, *Leonard*; Red river valley, *Scott*. [North of lake Superior, *Agassiz*.] Rare. North.

C. sessiliflora, Pursh. Pale Painted-Cup.

Frequent throughout the prairie portion of the state; extending northeast to the upper Mississippi river.

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*GERARDIA PURPUREA,' L., var. PAUPERCULA, Gray. A span to a foot high, smoother: stem more simple or with stricter branches: pedicels mainly opposite: flowers decidedly smaller: corolla usually only half inch long, lighter rose-purple; calyx-teeth deltoid-subulate from a broad base, leaving comparatively narrower sinuses. sometimes over half the length of the tube. *Gray's Synoptical Flora of N. A.*

†GERARDIA TENUIFOLIA, Vahl., var. ASPERULA, Gray. Distinguished by Professor Gray, from the typical G. tenuifolia, as follows: Leaves all nearly filiform, the upper side hispidulo-scabrous or asperulous (in the manner of G. aspera): inflorescence more paniculate and with the pedicels all ascending: corolla small, the expanded limb only half an inch in diameter.—Dry and bare hills and bluffs, Missouri to Minnesota, Wisconsin and Michigan. *Botanical Gazette*, vol. iv, p. 153: May, 1879.

ORTHOCARPUS, Nutt. ORTHOCARPUS.

O. luteus, Nutt.* Orthocarpus.

Lapham. North part of the Red river valley (Kittson county), *Upham;* Roseau prairie, *Scott;* Pembina, *Havard.* Northwest.

EUPHRASIA, Tourn. EYEBRIGHT.

E. officinalis, L. Eyebright.

North shore of lake Superior; "abundant everywhere about the edges of mossy thickets, especially on the rocky 'peninsula' at Grand Marais; in bloom the last of July and during August; small and little branched in exposed situations, larger and much branched among other vegetation." *Roberts.* North.

RHINANTHUS, L. YELLOW RATTLE.

R. Crista-galli, L. Yellow Rattle.

Lake Superior, Gray's *Manual*; doubtless in northeastern Minnesota (but probably not in the vicinity of Minneapolis, where it has been reported). North.

PEDICULARIS, Tourn. LOUSEWORT.

P. Canadensis, L. Common Lousewort. Wood Betony.

Common, in many places abundant, throughout the state, excepting perhaps northeastward. Flowers all greenish yellow, with no tinge of purple, upon extensive districts.

P. lanceolata, Michx. Lousewort.

Frequent southeastward; common westward and in the Red river valley.

MELAMPYRUM, Tourn. COW-WHEAT.

M. Americanum, Michx. Cow-Wheat.

Throughout the state; common or frequent northward, rare southward. Pine barrens, St. Croix river, *Parry;* Ramsey county, *Mrs. Terry;* north of lake Superior (common), *Juni, Roberts*; lake of the Woods, *Dawson.*

ACANTHACEÆ. ACANTHUS FAMILY.

RUELLIA, L. RUELLIA.

R. ciliosa, Pursh. Ruellia.

Lake Pepin, *Miss Manning.* Rare. Southeast.

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*ORTHOCARPUS, Nutt. Calyx tubular-campanulate, 4-cleft, or cleft anteriorly and posteriorly and the divisions 2-cleft or parted. Corolla mostly with slender tube; upper lip (galea) little longer and usually much narrower than the inflated 1- to 3-saccate lower one. Stamens 4; the smaller anther-cell sometimes wanting.—Low herbs, almost all annual (W. North American and one Chilian); with mainly alternate entire or 3- to 5-parted and laciniate leaves; the upper passing into bracts of the dense spike and not rarely colored, as also the calyx-lobes; the corolla yellow, or white with purple or rose-color, often much surpassing the calyx. Seeds numerous or rather few. Fl. spring and summer. §2. TRUE ORTHOCARPUS, Benth. Corolla with simply saccate lip inconspicuously or obsoletely 3-toothed, and moderately smaller ovate-triangular galea; its small tip or mucro usually somewhat inflexed or uncinate; stigma small, entire; anthers all 2-celled; seed-coat very loose, costate-reticulated; root annual.

O. LUTEUS, Nutt. Pubescent and hirsute, sometimes viscid; stem strict, a span to a foot high; leaves from linear to lanceolate, occasionally 3-cleft: bracts of the dense spike broader or with more dilated base, completely herbaceous, mostly 3-cleft, about equalling the flowers: corolla golden yellow, less than half inch long, twice or thrice the length of the calyx; tip of galea obtuse and straight. *Gray's Synoptical Flora of N.A.*

VERBENACEÆ. VERVAIN FAMILY.

VERBENA, Tourn. VERVAIN.

V. angustifolia, Michx. Narrow-leaved Vervain.

Stearns county, *Mrs. Blaisdell;* Goodhue county, *Sandberg;* lake Pepin, *Miss Manning*. Rare. Southeast.

V. hastata, L. Blue Vervain.

Common throughout the state, excepting far northward, where it is infrequent or rare, both in the Red river valley and about lake Superior; found at the lake of the Woods, *Dawson*.

V. urticæfolia, L. White Vervain. Nettle-leaved Vervain.

Frequency and range like the last.

V. stricta, Vent. Hoary Vervain.

Common, or frequent, on sandy land southward; extending north to the upper Mississippi river, *Houghton*.

V. officinalis, L. *European Vervain.*

Minneapolis, *Herrick*. Rare.

V. bracteosa, Michx. Prostrate Vervain.

Common through the south half of the state; extending north to the upper Mississippi river, *Houghton, Garrison*. (A probable hybrid between this species and V. stricta was found at Minneapolis in 1882. It was procumbent and much branched, much larger and coarser than V. bracteosa, covering a space about three feet in diameter; hirsute; leaves often 3- to 5-cleft; spikes clustered, loosely flowered; bracts inconspicuous, shorter than the calyx; flowers small, blue. *Upham.*)

LIPPIA, L. LIPPIA.

L. lanceolata, Michx. Fog-fruit.

Lake Pepin, *Miss Manning*. Rare. Southeast.

PHRYMA, L. LOPSEED.

P. Leptostachya, L. Lopseed.

Common, or frequent, through the south half of the state; extending north to Todd county, *Upham*, the upper Mississippi river, *Garrison*, and Fergus Falls, *Leonard*.

LABIATÆ. MINT FAMILY.

TEUCRIUM, L. GERMANDER.

T. Canadense, L. American Germander. Wood Sage.

Frequent, occasionally common, through the south half of the state and in the Red river valley to Pembina, *Havard*.

ISANTHUS, Michx.

I. cæruleus, Michx. False Pennyroyal.

Lake City, *Mrs. Ray*; Blue Earth county, *Leiberg*· Minneapolis, *Winchell, Roberts*. South.

MENTHA, Tourn. MINT.

M. viridis, L. *Spearmint.*

Often cultivated, and occasionally spontaneous, escaping from gardens.

M. piperita, L. *Peppermint.*

Occurring like the last.

M. Canadensis, L. Wild Mint.

Common throughout the state.

LYCOPUS, Tourn. WATER HOREHOUND.

L. Virginicus, L. Bugle-weed.

Frequent, especially northward; common north of lake Superior, *Juni, Roberts.*

L. rubellus, Mœnch. (L. Europæus, L., var. integrifolius, Gray.) Water Horehound.

Minneapolis, *Twining, Herrick;* upper Mississippi river, *Garrison;* Baptism river, *Juni.*

L. lucidus, Turcz., var. **Americanus,** Gray.* Water Horehound.

Blue Earth county, *Leiberg;* Bear lakes, Murray county, *Upham.* West.

L. sinuatus, Ell. (L. Europæus, L., var. sinuatus, Gray.) Water Horehound.

Frequent, or common, throughout the state.

PYCNANTHEMUM, Michx. MOUNTAIN MINT. BASIL.

P. lanceolatum, Pursh. Mountain Mint. Basil. "Pennyroyal."

Common, in many districts abundant, on moist land throughout the prairie portion of the state.

P. linifolium, Pursh. Mountain Mint. Basil.

Blue Earth county, *Leiberg.* South.

CALAMINTHA, Tourn., Mœnch. CALAMINT.

C. Nuttallii, Benth. (C. glabella, Benth., var. Nuttallii, Gray.) Calamint.

Falls of St. Anthony, *Wood's Class-Book.* Infrequent. East.

C. Clinopodium, Benth. Basil.

Stearns county, *Garrison.* Infrequent.

HEDEOMA, Pers. MOCK PENNYROYAL.

H. pulegioides, Pers. American Pennyroyal.

Upper Mississippi river, *Garrison;* lake Pepin, *Miss Manning.* Rare. South.

H. hispida, Pursh. Mock Pennyroyal.

Common, or frequent, through the south half of the state; extending north to the upper Mississippi river, *Garrison.*

MONARDA, L. HORSE-MINT.

M. fistulosa, L. Wild Bergamot.

Throughout the state: frequent northeastward; common, often abundant, southward and in the Red river valley.

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* LYCOPUS LUCIDUS, Turcz. Stem stout (2 to 3 feet high), erect, acute-angled at top; leaves lanceolate or oblong-lanceolate (2 to 4 inches long), acute or acuminate, with large and very sharp serrations, the base obtuse, or occasionally acute, subsessile; calyx-teeth alternate, subulate.—Var. AMERICANUS, Gray. Leaves barely shining on both sides, often hairy-pubescent; stem generally hairy; calyx-teeth small and rigid. *Gray's Revision of Lycopus, Proc. Amer. Acad.*, 1870.

M. punctata, L. Horse-Mint.

Upper Mississippi river, *Houghton;* Stearns county, *Mrs. Blaisdell;* Nicollet coun *Aiton* ; lake Pepin, *Miss Manning.* Rare. Southeast.

BLEPHILIA, Raf. BLEPHILIA.

B. ciliata, Raf. Blephilia.

Lapham. Rare. Southeast.

B. hirsuta, Benth. Blephilia.

Lapham. Infrequent. Southeast.

LOPHANTHUS, Benth. GIANT HYSSOP.

L. nepetoides, Benth. Giant Hyssop.

Falls of the St. Croix, *Parry;* Lac qui Parle county, *Upham.* South.

L. scrophulariæfolius, Benth. Giant Hyssop.

Frequent southward ; extending north to the upper Mississippi river, *Houghton.*

L. anisatus, Benth. Anise Hyssop.

Common, or frequent through the south half of the state ; abundant in the R river valley ; extending northeast to the upper Mississippi, *Houghton,* and Rainy La river, *Keating.* "All three of the above species are found side by side at the Falls the St. Croix." *Parry.*

NEPETA, L. CAT-MINT.

N. Cataria, L. *Catnip.*

Frequent throughout the state.

N. Glechoma, Benth. *Ground Ivy. Gill.*

Occasionally adventive : Todd county, *Upham;* Minneapolis (frequent), *Rober* Mankato, *Leiberg;* Lake City, *Miss Manning;* Emmet county, Iowa (rare). *Cratty.*

DRACOCEPHALUM, Tourn. DRAGON-HEAD.

D. parviflorum, Nutt. Dragon-head.

Throughout the state : frequent northward; rare southward.

PHYSOSTEGIA, Benth. FALSE DRAGON-HEAD. LION'S-HEAR

P. Virginiana, Benth. False Dragon-head. Lion's-heart.

Frequent through the south half of the state and in the Red river valley ; exten ing northeast to the upper Mississippi river, *Parry.*

BRUNELLA, Tourn. SELF-HEAL. HEAL-ALL.

B. vulgaris, L. Self-heal. Heal-all.

Throughout the state : common northward ; frequent southward.

SCUTELLARIA, L. SKULLCAP.

S. versicolor, Nutt. Skullcap.

Lapham. Shore of lake Pepin, in Wisconsin, *Miss Manning.* South.

S. parvula, Michx. Skullcap.

Frequent through the south half of the state

S. galericulata, L. Skullcap.

Common, or frequent, throughout the state.

S. lateriflora, L. Mad-dog Skullcap.

Commonness and range like the last.

MARRUBIUM, Tourn. HOREHOUND.

M. vulgare, L. *Horehound.*

Lake Pepin, *Miss Manning*. Infrequent.

GALEOPSIS, L. HEMP-NETTLE.

G. Tetrahit, L. *Common Hemp-Nettle.*

Abundant north of lake Superior; infrequent southward. *Mr. Roberts* describes it on the north shore of lake Superior as "very common, growing on the shingle especially; corolla almost universally white, marked with yellow in the throat; rarely purple."

STACHYS, Tourn. HEDGE-NETTLE. WOUNDWORT.

S. palustris, L. Hedge-Nettle. Woundwort.

Abundant on moist ground and margins of sloughs throughout the state; in many districts southwestward persisting as a weed in wheat-fields. (The tube of the corolla is abruptly constricted on the front side near its base, and within at that point bears short white hair. Floral leaves small, but much exceeding the sessile calyx.)

S. aspera, Michx. (S. palustris, L., var. aspera, Gray.) Hedge-Nettle. Woundwort.

Common north of lake Superior at Little Marais and Palisades, *Roberts*; Pembina, *Chickering, Scott*; Stearns county, *Garrison*; Minneapolis, *Twining, Kassube*; Blue Earth county, *Leiberg.*

LEONURUS, L. MOTHERWORT.

L. Cardiaca, L. *Common Motherwort.*

Becoming frequent southward: Minneapolis; Saint Paul; Stillwater; lake Pepin; Fillmore, Blue Earth and Martin counties.

LAMIUM, Tourn. DEAD-NETTLE.

L. amplexicaule, L. *Dead-Nettle.*

Excelsior, near Minneapolis, *Mrs. Herrick*; probably also at Duluth. This is likely to become a frequent weed.

BORRAGINACEÆ. BORAGE FAMILY.

SYMPHYTUM, Tourn. COMFREY.

S. officinale, L. *Comfrey.*

Escaped from cultivation: Minneapolis, *W. H. Hatch*; Goodhue county, *Sandberg*. Infrequent.

ONOSMODIUM, Michx. FALSE GROMWELL.

O. Carolinianum, DC. False Gromwell.

Frequent, occasionally common, through the south half of the state.

O. Carolinianum, DC., var. **molle,** Gray. (O. molle, Michx.) False Gromwell.

Winona county, *Holzinger;* Spring Valley, Fillmore county, *Dr. W. E. Leonard;* Scott county, *Winchell;* Nicollet county, *Aiton;* Blue Earth county, *Leiberg;* Fergus Falls, *Dr. H. C. Leonard;* Worthington (rare), *Foote.* South and west.

LITHOSPERMUM, Tourn. GROMWELL. PUCCOON.

[*L. arvense,* L., may be expected. It is reported in Michigan as a bad weed in wheat-fields.]

L. angustifolium, Michx. Narrow-leaved Gromwell.

Frequent southward and in the Red river valley; extending northeast to the upper Mississippi river. (The early-flowering state of this species, with the tube of the corolla much elongated, is described in Gray's *Manual* under the name L. longiflorum, Spreng.)

L. officinale, L. *Common Gromwell.*

Minneapolis, *Roberts, Herrick;* Brockway, Stearns county, *Miss Campbell.* Rare.

L. latifolium, Michx. Broad-leaved Gromwell.

Isanti county, *Upham;* Saint Paul, *Miss Cathcart;* near Meeker's island, Minneapolis, *Kassube;* Chaska, Carver county, *Juni;* Blue Earth county, *Leiberg;* Martin county (rare), *Cratty.* South.

L. hirtum, Lehm. Hairy Puccoon.

Common, often abundant, on sandy land in the south half of the state; extending north at least to Fergus Falls, *Leonard.*

L. canescens, Lehm. Hairy Puccoon or Alkanet. "Indian Paint."

Abundant, or common, through the south half of the state, and in the Red river valley; extending northeast to the upper Mississippi river. The red juice of the root is used by the Indians to paint their faces and for other purposes in dyeing.

[For L. longiflorum, Spreng., see L. angustifolium, Michx., above.]

MERTENSIA, Roth. SMOOTH LUNGWORT.

M. Virginica, DC. Virginian Cowslip or Lungwort. "Blue Bells."

Lapham. Rochester, Olmsted county, *Miss Beane;* Le Roy, Mower county, *Miss Bixby.* Southeast.

M. paniculata, Don. Smooth Lungwort.

Common on the north shore of lake Superior, *Juni, Roberts;* St. Louis river, *Mrs. Herrick.* "The flower-buds pink, turning blue as they open, thus giving the flowering plant a showy, variegated appearance. Still blooming in August." *Roberts.*

MYOSOTIS, L. SCORPION-GRASS. FORGET-ME-NOT.

M. arvensis, Hoffm. Forget-me-not.

Minneapolis (quite surely this species), *Herrick.* Rare.

M. verna, Nutt. Forget-me-not.

Pipestone county, *Mrs. Bennett.* Rare.

ECHINOSPERMUM, Swartz. STICKSEED. BUR-SEED.

E. floribundum, Lehm.* Stickseed. Bur-seed.

Red river near Saint Vincent, *Dawson.* West.

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*ECHINOSPERMUM FLORIBUNDUM, Lehm. Rather strict, two feet or more high, or sometimes smaller: leaves from oblong- to linear-lanceolate; the lowest tapering into

E. Lappula, Lehm. *Stickseed. Bur-seed. Stick-tight.*

Common, often abundant, through the south half of the state; less frequent in the Red river valley and the region of lake Superior (reported at Duluth, *Junt*, and in the vicinity of Saint Vincent, abundant, *Dawson*).

E. Redowskii, Lehm., var. **occidentale**, Watson. Stickseed. Bur-seed. "Stick-tight."

Frequency and range nearly like the last; but probably absent northeastward. (Procumbent and ascending, six to twelve inches high.)—The American plant is less strict, at length diffuse, and the tubercles or scabrosities of the nutlet are sharp instead of blunt or roundish, as in the Asiatic plant. *Gray's Synoptical Flora of N. A.*

E. Virginicum, Lehm. (Cynoglossum Morrisoni, DC.) Beggar's Lice. Stickseed. Bur-seed. "Stick-tight."

Common, or frequent, through the south half of the state; rare or less frequent northward.

CYNOGLOSSUM, Tourn. Hound's-Tongue.

C. officinale, L. *Hound's-Tongue.*

Becoming a frequent weed: lake Pepin, *Miss Manning;* Hastings, *Leonard*, and Mendota, Dakota county, *Kassube;* Nicollet county, *Aiton;* Jordan, Scott county, *Junt;* Stearns county, *Garrison*, *Campbell.*

C. Virginicum, L. Wild Comfrey.

Goodhue county, *Sandberg*; Stearns county, *Upham;* St. Louis river, *Mrs. Herrick*. East and north.

ASPERUGO, Tourn. German Mudwort.

A. procumbens, L.† *German Mudwort.*

Adventive, but scarcely established, at Pipestone City, *Mrs. Bennett.* Rare.

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margined petioles: racemes numerous, commonly geminate and in fruit rather strict: nutlets with elongated triangular back naked (2 lines long), merely scabrous; and the margin armed with a close row of flat subulate prickles, their bases often confluent; scar smaller and narrowly ovate. Limb of corolla varying from 2 to 5 lines in diameter. *Gray's Synoptical Flora of N. A.*

*Echinospermum deflexum, Lehm. Diffusely branched, a foot or so high: leaves from oblong to lanceolate: racemes lax, loosely paniculate: flowers soon sparse, smaller than in the preceding: nutlets smaller, and the mostly naked back (a line long) broader. . . . . . Habit intermediate between the preceding and E. Virginicum, Lehm.; the American specimens having occasionally some few prickles developed from the rough-granulate dorsal face of the nutlets. Fruit as well as flowers about half the size of that of E. floribundum. *Gray's Synoptical Flora of N. A.*

† Asperugo, Tourn. Calyx when in flower nearly regular, deeply 5-cleft, in fruit 2-lobed, with the lobes valvate, closed, flattish, palmately laciniate, the one 6- and the other 7-toothed. Corolla funnelshaped-salvershaped; the throat closed by 5 obtuse scales; limb concave, 5-lobed. Stamens included. Nucules laterally compressed, nearly smooth with raised dots, attached by their narrow inner edge to the conical receptacle. A rough herb with fragile juicy stems, and small axillary purplish-blue flowers. Calyx much enlarged and veined in fruit, somewhat like the perianth of the female flowers of the genus Atriplex.

A. procumbens, L. The only known species. Annual; stem 1 to 3 feet long, procumbent or trailing, succulent, brittle, angular, thinly studded with reflexed prickles,

HYDROPHYLLACEÆ. WATERLEAF FAMILY.

HYDROPHYLLUM, Tourn. WATERLEAF.

H. Virginicum, L. Waterleaf.

Common, occasionally abundant, through the south half of the state; extending north at least to Morrison county (plentiful), *Upham*, and Clay county in the Red river valley, *Gedge*.

H. appendiculatum, Michx. Waterleaf.

Lake Pepin, *Miss Manning*; Blue Earth county, *Leiberg*. South.

ELLISIA, L. ELLISIA.

E. Nyctelea, L. (Including the slender form, E. ambigua, Nutt., which prevails here.) Ellisia.

Frequent through the south half of the state and in the Red river valley.

PHACELIA, Juss. PHACELIA.

P. Purshii, Buckley. Phacelia.

Gray's *Synoptical Flora of N. A.*; Goodhue county, *Sandberg*. Rare. Southeast.

P. Franklinii, Gray. Phacelia.

Shores of lake Superior, especially on Isle Royale, Gray's *Manual;* abundant at Port Arthur, *Macoun;* surely also in northern Minnesota.

POLEMONIACEÆ. POLEMONIUM FAMILY.

POLEMONIUM, Tourn. GREEK VALERIAN.

P. reptans, L. Greek Valerian.

Hesper, Iowa, adjoining Fillmore county (common), *Mrs. Carter;* Winona, *Holzinger;* lake Pepin, *Miss Manning;* Cannon River Falls, *Blake*, *Sandberg;* extending northwest to New Ulm, *Leiberg*, and Alexandria, *Mrs. Terry*. Infrequent. Southeast.

PHLOX, L. PHLOX.

P. maculata, L. Wild Sweet William.

Northfield, Rice county, *Chaney*; Dakota county, *Winchell*, *Upham;* Minneapolis, *Herrick* South.

P. glaberrima, L. Phlox.

St. Croix Falls, *Miss Field*; New Ulm, *Juni;* upper Mississippi river, *Garrison*. Infrequent. South.

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by which they readily adhere to the clothes of passers-by and to the coats of animals. Leaves oblanceolate, subobtuse, the lower ones narrowed into winged petioles and slightly decurrent, those on the upper part of the stem scarcely stalked, nearly opposite, or 3 or 4 in a whorl, more or less clothed with hairs, many of which are hooked-pointed. Peduncles very short, at first erect, afterwards recurved, 1-flowered. Corolla ⅙ inch across, dull purplish blue. Calyx in fruit ¼ inch long, dorsally compressed, of 2 palmately laciniate valves, adpressed to each other, with a prominent network of veins, sparingly ciliated and clothed with bristly hairs. Nucules yellowish-gray, one-fifth inch long, thickly studded with smooth white scale-like patches. *Sowerby's English Botany*, vol. vii.

Common throughout the prairie portion of the state; extending northeast to the upper Mississippi river, *Houghton*, *Garrison*.

P. divaricata, L. Phlox.

Frequent, or common, southward; extending north to Minneapolis (common), *Roberts*, and Redwood Falls, *Pemberton*. [The var. Laphamii, Wood, occurs at Minnehaha falls (plentiful), *Roberts*, and is also common at Hesper, Iowa, *Mrs. Carter*.]

COLLOMIA, Nutt. COLLOMIA.

C. linearis, Nutt.* Collomia.

Pipestone county, *Mrs. Bennett*. [Upper Missouri river, *Geyer*.] West.

CONVOLVULACEÆ. CONVOLVULUS FAMILY.

CONVOLVULUS, L BINDWEED.

C. sepium, L. (Calystegia sepium, R. Br.) Hedge Bindweed. Bracted Bindweed.

Common through the south half of the state and in the Red river valley; extending northeast to the upper Mississippi river; also, St. Louis river, *Mrs. Herrick*, and probably throughout Minnesota.

C. sepium, L., var. **repens,** Gray.† (var. pubescens, Gray, in *Manual*.)

Clay county, in the Red river valley, *Gedge*.

C. spithamæus, L. (Calystegia spithamæa, Pursh.) Bracted Bindweed.

Throughout the state, but infrequent. Winona county, *Holzinger*; lake Pepin, *Miss Manning*; Dellwood, White Bear lake, Ramsey county, *Kelley*; near Minneapolis (rare), *Kassube*; Stearns county, *Mrs. Blaisdell*; St. Louis river, *Mrs. Herrick*; Red river prairie (rare), *Dawson*; Pembina (in woods), *Chickering*.

CUSCUTA, Tourn. DODDER.

C. tenuiflora, Engelm. Dodder.

Lapham. Blue Earth county, *Leiberg*, determined by *Watson*. South.

C. chlorocarpa, Engelm. Dodder.

Minneapolis, *Kassube*; Blue Earth county, *Leiberg*. South.

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*COLLOMIA, Nutt. Corolla tubular-funnelform or salverform with a more or less dilated throat. Filaments slender, unequally inserted, usually protruded. Ovules solitary, few or many in each cell. Seed-coat developing mucilage and projecting numerous spiral threads (spiricles) when wetted (except in C. gracilis). Annuals or some biennials, with alternate leaves (or only the lower ones opposite), which are usually pinnately incised or divided, and with clustered or sometimes scattered flowers.

C. LINEARIS, Nutt. Annual, more or less viscid-pubescent, becoming glabrate below, glandular above; stems erect, simple or branching, 6 to 18 inches high; leaves sessile, lanceolate, very entire; heads crowded; lobes of the calyx triangular-lanceolate, acute; corolla light blue or nearly white, 6 lines long, slender, but little enlarged at the throat, the limb small; ovules solitary; seeds with very numerous spiricles. *Porter and Coulter's Flora of Colorado*, and *Botany of King's Report*, following Gray's *Revision of N. A. Polemoniaceæ*, *Proc. Amer. Acad.*, 1870, vol. viii.

†CONVOLVULUS SEPIUM, L., var. REPENS, Gray. Corolla from almost white to rose-color: bracts from very obtuse to acute: herbage from minutely to tomentose-pubescent: sterile and sometimes flowering stems extensively prostrate: leaves more narrowly sagittate or cordate, the basal lobes commonly obtuse or rounded and entire. *Gray's Synoptical Flora of N. A.*

C. Gronovii, Willd. Dodder.

Common, or frequent, through the south half of the state and in the Red river valley.

C. Gronovii, Willd., var. **latiflora**, Engelm. Dodder.

Doubtless in this state; as it occurs at Hesper, in the north edge of Iowa (on Impatiens fulva), *Mrs. Carter, Arthur*. [A form with flowers of more delicate texture, and shorter tube and longer lobes to the corolla. *Gray's Synoptical Flora of N. A.*]

C. glomerata, Choisy. Dodder.

Frequent, or common, through the south part of the state; extending north to Stearns county, *Campbell*, and Redwood Falls, *Miss Butler*.

SOLANACEÆ. NIGHTSHADE FAMILY.

SOLANUM, Tourn. NIGHTSHADE.

S. Dulcamara, L. *Bittersweet*.

Stillwater, *Miss Field*; Lake City, *Mrs. Ray*. Infrequent.

S. nigrum, L. Common Nightshade. Black Nightshade.

Common through the south half of the state, especially southwestward, where the berries are often used for pies and sauce. Indigenous; also cosmopolitan.

PHYSALIS, L. GROUND CHERRY.

P. grandiflora, Hook. Ground Cherry.

Upper Mississippi river, *Garrison*; Stearns county, *Mrs. Blaisdell*; St. Louis river, *Mrs. Herrick*. North.

P. Philadelphica, Lam. Ground Cherry.

Lake Pepin, *Miss Manning*; Blue Earth county, *Leiberg*; Redwood Falls, *Pemberton*. South.

P. angulata, L. Ground Cherry.

Lapham. Minneapolis, *Twining, Simmons*. Rare. South.

P. pubescens, L. Ground Cherry.

Frequent, or common, in the south part of the state; extending west at least to Worthington, Nobles county (common), *Foote*, and north to New Ulm and Anoka county, *Juni*, and Stearns county, *Campbell*.

P. Virginiana, Mill. (P. viscosa, in Gray's *Manual*.) Ground Cherry.

Frequent southward; extending north to the upper Mississippi river. *Garrison*. [North of lake Superior, *Agassiz*; Pembina mountain, *Havard*.]

P. Virginiana, Mill., var. **ambigua**, Gray. Ground Cherry.

A coarse and very villous form with anthers violet!—Wisconsin (*Lapham*) to Saskatchewan, *Bourgeau, Drummond*, &c., *Gray's Synoptical Flora of N. A.*; therefore doubtless in Minnesota.

P. lanceolata, Michx. (P. Pennsylvanica, in *Manual*.) Ground Cherry.

Common, or frequent, through the south half of the state and in the Red river valley; extending northeast to Itasca lake, *Houghton*.

NICANDRA, Adans. APPLE

LYCIUM, L. MATRIMONY-VINE.

L. vulgare. Dunal. *Matrimony-Vine.*

Adventive, Minneapolis, *Juni, Roberts.* Infrequent.

DATURA, L. JAMESTOWN-WEED. THORN-APPLE.

D. Stramonium, L. *Common Stramonium or Thorn-Apple.*

Stearns county, *Campbell*, Minneapolis, *Roberts*; Goodhue county, *Sandberg*; Blue Earth county, *Leiberg*. Infrequent. South.

D. Tatula, L. *Purple Thorn-Apple.*

Saint Paul, *Miss Cathcart*; Goodhue county, *Sandberg*; lake Pepin, *Miss Manning*. Rare. South.

NICOTIANA, Tourn. TOBACCO.

N. rustica, L. *Wild Tobacco.*

Near Clotho, Todd county, *Upham*; "a relic of cultivation by the Indians." Rare.

GENTIANACEÆ. GENTIAN FAMILY.

HALENIA, Borkh. SPURRED GENTIAN.

H. deflexa. Griseb. Spurred Gentian.

Common north of lake Superior, *Juni, Roberts*; lake of the Woods, *Dawson*. North.

GENTIANA, Tourn. GENTIAN.

G. Amarella, L., var. **acuta**, Hook. f.* Gentian.

Red river valley near Saint Vincent, *Scott*: determined by *Watson*. Northwest.

G. quinqueflora, Lam., var. **occidentalis**, Gray. Five-flowered Gentian.

Frequent, or occasional, through the south part of the state; extending north to Saint Paul and White Bear lake, *Mrs. Terry*, Stillwater, *Miss Field*, and the upper Mississippi river, *Garrison*. [Common at Hesper, *Mrs. Carter*, and in Emmet county, Iowa, *Cratty*.

G. crinita, Frœl. Fringed Gentian.

Common, or frequent, throughout the state.

G. serrata, Gunner. (G. detonsa, in *Manual*.) Smaller Fringed Gentian.

Also common throughout the state. This and the preceding grow together, and in many places are very abundant locally.

G. alba, Muhl. Whitish Gentian.

Throughout the state, but infrequent. Hesper, *Mrs. Carter*; Winona, *Holzinger*; Cannon River Falls, *Blake, Sandberg*; Faribault, *Miss Beane*; Saint Paul, *Miss Cathcart*;

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*GENTIANA AMARELLA. L. From 2 to 20 inches high: leaves from lanceolate to narrowly oblong, or the lowest obovate-spatulate: inflorescence disposed to be racemiform: calyx 5-cleft (or rarely 4-cleft) below the middle; the lobes lanceolate or linear, equal or one or two of them longer, all shorter than the mostly blue corolla: the latter (funnelform, with entire lobes) half inch or more long; its lobes oblong, obtuse or becoming acute (with setaceous-fimbriate crown on their base): capsule sessile.—Var. ACUTA. Hook. f. Calyx almost 5-parted; crown usually of fewer and sometimes very few setæ. *Gray's Synoptical Flora of N. A.*

Minneapolis, *Roberts;* St. Croix Falls, *Miss Field;* New Ulm, *Juni;* Stearns county, *Campbell;* Roseau river, *Scott.*

G. Andrewsii, Griseb. Closed Gentian.

Frequent through the south half of the state and in the Red river valley; extending northeast to the upper Mississippi river, *Geyer, Garrison.*

G. Saponaria, L. Soapwort Gentian.

Lapham. Cannon river, *Geyer;* Anoka county, *Juni;* Pembina, *Havard.* Infrequent. South and west.

G. linearis, Frœl., var. **lanceolata,** Gray.* Gentian.

Minnesota and along lake Superior, Gray's *Synoptical Flora of N. A.;* frequent on prairies, Blue Earth county, *Leiberg.*

G. puberula, Michx. Gentian.

Common, or frequent, through the south half of the state and in the Red river valley (common northward to Ada, Norman county, *Upham,* and infrequent to the vicinity of Saint Vincent, *Scott*).

G. affinis, Griseb.† Gentian.

Lapham. Red river, *Watson* in King's *Report;* near Saint Vincent, *Scott,* determined by *Watson.* West.

MENYANTHES, Tourn. BUCKBEAN.

M. trifoliata, L. Buckbean.

Common throughout the state.

LIMNANTHEMUM, Gmelin. FLOATING HEART.

L. lacunosum, Griseb. Floating Heart.

In a lake near Alexandria, Douglas county, *Mrs. Terry.* Rare.

APOCYNACEÆ. DOGBANE FAMILY.

APOCYNUM, Tourn. DOGBANE. INDIAN HEMP.

A. androsæmifolium, L. Spreading Dogbane.

Common throughout the state.

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*GENTIANA LINEARIS, Frœl. (G. Saponaria, L., var. linearis, Griseb.) Smooth throughout: stem slender and strict, a foot or two high: leaves linear or narrowly lanceolate, 1½ to 3 inches long, 2 to 5 lines wide, and with somewhat narrowed base: flowers 1 to 5 in the terminal involucrate cluster, and often solitary in one or two axils below: calyx-lobes linear or lanceolate, shorter than the tube: corolla blue, an inch or more long, narrow-funnelform; the erect lobes roundish-ovate and obtuse, 2 lines long, a little longer than the triangular acute and entire or slightly 1- to 2-toothed appendages.—Var. LANCEOLATA. Leaves lanceolate, or the upper and involucrate ones almost ovate-lanceolate (1 or 2 inches long and even half inch wide): appendages of the sinuses of the corolla sometimes very short and broad. . . . Approaches narrow-leaved forms of G. alba. *Gray's Synoptical Flora of N. A.*

†GENTIANA AFFINIS, Griseb. Stems clustered, a span to a foot high, mostly ascending: leaves from oblong to lanceolate or linear: flowers from numerous and thyrsoid-racemose to few or rarely almost solitary: bracts lanceolate or linear: calyx-lobes linear or subulate, unequal and variable, the longest rarely equalling the tube, the shorter sometimes minute: corolla an inch or less long, rather narrowly funnelform; its lobes ovate, acutish or mucronulate-pointed, spreading. *Gray's Synoptical Flora of N. A.*

A. cannabinum, L. Indian hemp.

Also common throughout the state. (Polymorphous; the **var. glaberrimum**, **DC.**, has been noted in Faribault county, *Upham;* and **var. hypericifolium, Gray, at lake Minnetonka,** *Roberts*, St. Louis river, *Mrs. Herrick*, and Pembina, *Havard;* **var. pubescens.** DC., probably also occurs here; but intermediate forms are found, "rendering useless any sub-specific names."

ASCLEPIADACEÆ. MILKWEED FAMILY.

ASCLEPIAS, L. MILKWEED. SILKWEED.

A. speciosa, Torr.* Milkweed. Silkweed.

Red river valley, in Clay county (frequent on portions of the prairie which are intermediate between wet and dry), *Upham;* Big Stone county, *Campbell*, determined by *Prof. Asa Gray;* extending east to the central part of Minnesota, *Rev. E. L. Greene*, and Martin county, *Gedge*, *Leiberg*. [Frequent in Emmet county, Iowa (sometimes troublesome in grain-fields, like A. Cornuti elsewhere), *Cratty*.] West.

A. Cornuti. Decaisne. Common Milkweed or Silkweed.

Common throughout the state, excepting perhaps northeastward.

A. Sullivantii, Engelm. Sullivant's Milkweed.

Common, or frequent, across the south part of the state; extending north to Blue Earth county, *Gedge*, Brown county, *Juni*, wet prairies of central Minnesota, *Rev. E. L. Greene*, and in the Red river valley at least to Clay county (frequent), *Gedge*.

A. phytolaccoides, Pursh. Poke-Milkweed.

St. Croix river, *Parry;* lake Pepin, *Miss Manning;* Minneapolis, *Herrick*, *Hatch;* Stearns county, *Upham;* Detroit, Becker county, *Gedge*. Infrequent. South.

A. purpurascens, L. Purple Milkweed.

Lake Pepin, *Miss Manning;* Stillwater, *Miss Field;* Hennepin county, *Herrick*, *Hatch;* upper Mississippi river, *Garrison*. Infrequent. South.

A. ovalifolia. Decaisne. Milkweed.

Frequent throughout the prairie region of the state: common in Benton, Stearns and Todd counties (in oak openings and prairies), *Upham;* the most common species of this genus in the Red river valley, *Gedge*.

A. quadrifolia, L. Four-leaved Milkweed.

Shores of lake Pepin, both in Minnesota and Wisconsin, *Miss Manning*. Rare. South.

A. incarnata, L. Swamp Milkweed.

Common throughout the state.

A. incarnata, L., var. **pulchra**, Pers. Swamp Milkweed.

Minneapolis, *Kassube*.

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*ASCLEPIAS SPECIOSA, Torr. Finely canescent-tomentose, rarely glabrate with age: leaves from subcordate-oval to oblong, thickish: peduncles shorter than the leaves: pedicels of the many-flowered dense umbel and the calyx densely tomentose: flowers purplish, large: corolla-lobes ovate-oblong, 4 or 5 lines long: hoods 5 or 6 lines long, spreading, the dilated body and its short inflexed horn not surpassing the anthers, but the center of its truncate summit abruptly produced into a lanceolate-ligulate thrice longer termination: column hardly any: wings of the anthers notched and obscurely corniculate at base.—Follicles echinate with soft spinous processes and densely tomentose, large (3 to 5 inches long) and ventricose, ovate and acuminate, arrect on deflexed pedicels: leaves large and broad, short-petioled, transversely veined: stems stout and simple, 2 to 5 feet high. *Gray's Synoptical Flora of N. A.*

A. obtusifolia, Michx. Milkweed.

Lapham. South.

A. tuberosa, L. Butterfly-weed. Pleurisy-root.

Common, or frequent, through the south half of the state; extending north to the upper Mississippi river, *Garrison,* and Fergus Falls, *Leonard;* not observed in Clay county, *Gedge.*

A. verticillata, L. Whorled Milkweed.

Frequent southeastward; extending north to Otter Tail county, *Upham,* Clay county (common), *Gedge,* and Pembina, *Chickering.*

ACERATES, Ell. GREEN MILKWEED.

A. viridiflora, Ell. Green Milkweed.

Occasional through the south half of the state and in the Red river valley.

A. viridiflora, Ell., var. **lanceolata,** Gray. Green Milkweed.

Blue Earth county (frequent), *Leiberg;* Clay county, Red river valley, *Gedge.* [With lanceolate leaves 2½ to 4 inches long. *Gray's Synoptical Flora of N. A.*]

A. viridiflora, Ell., var. **linearis,** Gray. Green Milkweed.

Clay county, *Gedge.* West. [With elongated linear leaves and low stems: umbels often solitary.—Winnipeg Valley to New Mexico. *Gray's Synoptical Flora of N. A.*]

A. lanuginosa, Decaisne. Green Milkweed.

Winona county, *Holzinger;* Blue Earth county, *Leiberg;* Minneapolis, *Juni, Roberts;* Redwood Falls, *Pemberton;* Clay county, Red river valley, *Gedge.* (Specimens with some of the leaves having two equally prominent midribs and the end bifid were collected in Clay county by *Prof. Gedge.*) South and west.

A. longifolia, Ell. Green Milkweed.

Freeborn county, *Upham;* Cannon River Falls, *Blake, Sandberg;* frequent in Martin county, and in Emmet county, Iowa, *Cratty;* Stearns county, *Mrs. Blaisdell;* upper Mississippi river, *Garrison.* South.

OLEACEÆ. OLIVE FAMILY.

FRAXINUS, Tourn. ASH.

F. Americana, L. White Ash.

Frequent, often common, throughout the state, excepting far northward. The white and black ash are well known as valuable timber trees.

F. pubescens, Lam. Red Ash.

Frequent from lake Pepin, *Miss Manning,* to Stearns and Todd counties and Sand Hill river, *Upham;* the White Earth reservation, *Garrison;* reaching its northern limit on Rainy river, *Richardson.*

F. viridis, Michx. f. Green Ash.

Common, or frequent, throughout the state; extending north at least to Rainy river and the lake of the Woods, and common along the Red river in Manitoba, *Bell;* the most common species of ash in Iowa, *Arthur.*

F. sambucifolia, Lam. Black Ash.

Frequent, occasionally plentiful, throughout the state, excepting perhaps southwestward. [Its northwestern limit reaches the southern part of lake Winnipeg, and thence extends southward along the east side of Red river, *Bell.*]

F. quadrangulata, Michx. Blue Ash.

Upper Mississippi river, *Garrison;* near the Rainy lake valley, *Clark.* Rare.

ARISTOLOCHIACEÆ. BIRTHWORT FAMILY.

ASARUM, Tourn. ASARABACCA. WILD GINGER.

A. Canadense, L. Asarabacca. Wild Ginger.

Common, or frequent, throughout the state.

ARISTOLOCHIA, Tourn. BIRTHWORT.

A. Sipho, L'Her. Pipe-Vine. Dutchman's Pipe.

Fillmore, Houston and Ramsey counties, *Winchell*; Rice county, *Sperry*; la Pepin, *Miss Manning*. Southeast.

NYCTAGINACEÆ. FOUR-O'CLOCK FAMILY.

OXYBAPHUS, Vahl. OXYBAPHUS.

O. nyctagineus, Sweet. Oxybaphus.

Common, or frequent, through the south half of the state; extending north to t upper Mississippi river, *Parry*, *Garrison*, and Sand Hill river, *Upham*; also found the lake of the Woods (sandy ridges of southern shore), *Dawson*.

O. hirsutus, Sweet. Oxybaphus.

Frequent southward; extending north to Minneapolis and Big Stone lake, *Uph* and to Pembina, *Havard*. South and west. [One foot high. hirsute througho leaves lanceolate, thick, the lower short-petioled: fruit of O. nyctagineus. *Botan King's Expl. of the Fortieth Parallel.*]

O. angustifolius, Sweet. Oxybaphus.

Frequent through the south half of the state. Southwest. [One to six f high, glabrous, except the peduncles and involucres; leaves linear. *Botany of Ki Expl. of the Fortieth Parallel.* In all these species the fruit is pubescent, and the volucre always 3- to 5-flowered.]

PHYTOLACCACEÆ. POKEWEED FAMILY.

PHYTOLACCA, Tourn. POKEWEED.

P. decandra, L. Garget. Poke. Scoke. Pigeon-Berry.

Throughout the south half of the state, but infrequent or rare. Blue Earth cou *Leiberg*; Minneapolis, *A. W. Jones*; upper Mississippi river, *Garrison*.

CHENOPODIACEÆ. GOOSEFOOT FAMILY.

CYCLOLOMA, Moquin. WINGED PIGWEED.

C. platyphyllum, Moquin. Winged Pigweed.

Beach at northwest side of Mille Lacs (plentiful), and north end of Long la Crow Wing county, *Upham*.

CHENOPODIUM, Tourn. (Including BLITUM, Tourn.) GOO FOOT. PIGWEED.

C. album, L. *Lamb's-Quarters. Pigweed.*

A common weed in waste and cultivated ground throughout the state.

C. Boscianum, Moquin.* (C. album, L., var. Boscianum, Gray, in *Manual.*) Goosefoot.

Stony Point, lake Madison, Blue Earth county, *Gedge.* South.

C. urbicum, L. *Goosefoot.*

Red river valley at Pembina, *Havard.* Infrequent.

C. urbicum, L., var. *rhombifolium*, Moquin. *Goosefoot.*

Stillwater, *Miss Field.* Infrequent.

C. hybridum, L. *Maple-leaved Goosefoot.*

Frequent, often common, throughout the state.

C. Botrys, L. *Jerusalem Oak. Feather Geranium.*

Northeastward, *Clark;* Minneapolis, *Herrick* ; Stillwater (plentiful), *Miss Butler, Miss Field.* Infrequent.

[*C. ambrosioides*, L., will probably extend to Minnesota.]

C. rubrum, L., var. **humile**, Watson. (Blitum maritimum, Nutt.) Coast Blite.

Lapham. Northwest. [Var. HUMILE, Watson. Smaller, prostrate or ascending: leaves ovate to lanceolate, often hastate, an inch long or less, rarely toothed: flowers in axillary or somewhat spicate clusters. *Watson, Botany of California.*]

C. capitatum, Watson. (Blitum capitatum, L.) Strawberry Blite.

Stillwater, *Miss Field;* Stearns county, *Mrs. Blaisdell;* north of lake Superior *Agassiz;* Carlton county, and Minnesota Point, lake Superior (juice of the fruit used by the Chippewa Indians for staining), *Roberts.* North.

C. Bonus-Henricus, L. (*Blitum Bonus-Henricus*, Reich.) *Good-King-Henry.*

Lake of the Woods, *Dawson.* Rare.

[Atriplex patula, L., var. hastata, Gray, and var. littoralis, Gray, will probably be found on the shore of lake Superior in Minnesota.]

CORISPERMUM, Ant. Jussieu. BUG-SEED.

C. hyssopifolium, L. Bug-seed.

Minnesota Point (plentiful), also near Minneapolis, *Roberts;* northwest beach of Mille Lacs (abundant), *Upham;* Red river, *Hooker, Watson.* Local.

SALICORNIA, Tourn. GLASSWORT. SAMPHIRE.

S. herbacea, L. Glasswort. Samphire.

In the vicinity of a salt spring on the bank of the Red river near Saint Vincent, *Say, Nuttall.* Rare.

SUÆDA, Forskal. SEA BLITE.

S. depressa, Watson.† Sea Blite.

Lapham Red river valley near Saint Vincent (common), *Upham;* Pembina, dr plains, *Chickering.* Northwest.

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* CHENOPODIUM BOSCIANUM, Moquin. Erect, slender, 2 feet high, loosely branched nearly glabrous; leaves thin, oblong to linear-lanceolate, 1 to 2 inches long, acute, at tenuate into a long, slender petiole, the lower sinuate-dentate, or often all entir flowers very small, solitary, or in small clusters upon the slender branchlets; caly green, not strongly carinate, partly covering the at length naked seed, which is ½ lin broad. *Watson's Revision of Chenopodium, Proc. Am. Acad.*, vol. ix.

†SUÆDA DEPRESSA, Watson. Annual: low and mostly decumb the base, with usually short ascending leafy

AMARANTACEÆ. AMARANTH FAMILY.

AMARANTUS, Tourn. AMARANTH.

A. retroflexus, L. *Pigweed. Red-root.*

A common weed throughout the state.

A. albus, L. *Tumble-weed.*

Frequent southeastward and in the Red river valley; abundant southwestward, on both the longest cultivated and the newly broken land. (North of lake Superior, *Agassiz;* "sandy shore of the upper Missouri" [probably there indigenous, and perhaps so in western Minnesota], *Geyer.*) The popular name alludes to the behavior of this plant in autumn and winter, as described by *Arthur*: "It grows in a globular form, often three or four feet in diameter. When killed by frost, the branches remain rigid, the plant soon loosens from the soil, and the wind drives it bounding over the fields and prairies, until brought up in some fence corner. When the corner is full, those that follow are enabled to scale the fence. With a change of wind, all the lodged plants are set flying in another direction. This is an effective method of scattering the seeds."—Prairie fires are sometimes carried by these rolling dead weeds across broad fire-breaks of plowed land.

A. blitoides, Watson.* Amaranth.

Mankato (a common weed by roadsides and in waste places), *Leiberg;* Martin county, and in Emmet county, Iowa, (rare), *Cratty*. South. "It grows flat upon the ground like purslane, and has a dark green, glossy leaf, not much larger than that of purslane, but thinner. It is a native of the western plains, but is traveling eastward as a weed. It is abundant in Iowa at Clear Lake and southward." *Arthur.*

ACNIDA, L. WATER-HEMP.

A. tuberculata, Moquin. (Montelia tamariscina, Gray, in part, and its var. concatenata, Gray.) Water-Hemp.

St. Croix river, *Parry;* common on gravelly shores of the Le Sueur and Minnesota rivers in Blue Earth county, *Leiberg;* also common in Martin county, and in Emmet county, Iowa, *Cratty*. "Sometimes erect, and from one to four feet high; sometimes spreading or prostrate." South.

FRŒLICHIA, Mœnch. FRŒLICHIA.

F. Floridana, Moquin. Frœlichia.

Lapham. Minneapolis, *Roberts*. Rare. South.

POLYGONACEÆ. BUCKWHEAT FAMILY.

POLYGONUM, L. KNOTWEED. POLYGONUM.

P. viviparum, L. Alpine Bistort.

Grand Marais, lake Superior, *Roberts*. North.

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base, semiterete, ¼ to 1 inch long, the floral ones oblong- to ovate-lanceolate or ovate, acute, rather crowded: calyx cleft to the middle somewhat unequally, one or more of the acute lobes strongly carinate or crested: seed vertical or horizontal, half a line broad, very lightly reticulated. *Watson, Botany of California.*

*AMARANTUS BLITOIDES, Watson. Prostrate or decumbent, the slender stems becoming a foot or two long, glabrous or nearly so; leaves broadly spatulate to narrowly oblanceolate, attenuate to a slender petiole, an inch long or usually less; flowers in small contracted axillary spikelets; bracts nearly a line broad. *Proc. Amer. Acad.*, vol. xii.

P. orientale, L. *Prince's Feather.*

Lake Pepin, *Miss Manning*. Infrequent.

P. Pennsylvanicum, L. Knotweed. Polygonum.

Frequent, or common, through the south half of the state and in the Red river valley.

P. incarnatum, Ell. Polygonum.

Frequent, or common, through the south half of the state.

P. lapathifolium, Ait., var. **incanum,** Koch. Polygonum.

Minneapolis, *Roberts;* lake Pepin, *Miss Manning*. Rare. North.

P. Persicaria, L. *Lady's Thumb. Heartweed.*

Common throughout the state, excepting near its west side, where this and the two following species seem to be less frequent or rare.

P. Hydropiper, L. Common Smartweed or Water-pepper.

Common, often abundant, with range like the last.

P. acre, HBK. Water Smartweed.

Common, with same range.

P. hydropiperoides, Michx. Mild Water-pepper.

Frequent, or common, southward; also found at the lake of the Woods, *Dawson*, and in the Red river valley, *Scott.*

P. amphibium, L., var. **aquaticum,** Willd. Polygonum.

Frequent, often common, throughout the state.

P. Muhlenbergii, Watson.* (P. amphibium, var. terrestre, in *Manual.*) Polygonum.

Common, or abundant, throughout the state.

P. Hartwrightii, Gray.† Polygonum.

Minneapolis (common), *Arthur;* Blue Earth county, *Leiberg;* Emmet county, Iowa (common), *Cratty*. Probably common, or frequent, throughout Minnesota.

P. Virginianum, L. Polygonum.

Lapham. St. Croix river, *Parry;* Blue Earth county, *Leiberg*. South.

P. articulatum, L. Jointweed.

Sandy barrens, St. Croix river, *Parry;* New Ulm, *Juni;* Minnesota Point, near Duluth (plentiful), *Roberts*. [Upper Missouri river, *Geyer.*]

P. aviculare, L. Knotgrass. Goose-grass. Door-weed.

Common throughout the state.

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*POLYGONUM MUHLENBERGII, Watson. Perennial, in muddy or dry places, often 2 or 3 feet high, scabrous with short appressed or glandular hairs, especially upon the leaves and upper stems; leaves thin, rather broadly lanceolate, long-acuminate, usually rounded or cordate at base, 4 to 7 inches long, on short stout petioles (¼ to 1 inch long) from near the base of the naked sheath; flowers and fruit nearly as in P. amphibium, but spikes more elongated (1 to 3 inches long), often in pairs. *Proc. Amer. Acad.*, xiv.

†POLYGONUM HARTWRIGHTII, Gray. Strigose-hirsute or glabrous; stem erect, striate, bearing at the top thickish leaves which are broadly lanceolate, acute or somewhat obtuse; petioles short; sheaths long with a flat foliaceous limb, which is setose-ciliate; peduncle erect, eglandulose, bearing a solitary dense cylindrical spike of rose-colored flowers: stamens 5; style deeply cleft: perigonium eglandulose. *Proc. Amer. Acad.*, viii.

P. erectum, L. (P. aviculare. L., var. erectum, Roth.) Erect Knotgrass.

Also common, or frequent: Winona, Blue Earth, Hennepin and Stearns counties, etc.; Worthington (common). *Foote;* Crookston, Grand Forks, and elsewhere in the Red river valley (common), *Winchell;* Pembina, *Havard*

P. ramosissimum, Michx. Polygonum.

Brown county, *Juni;* Martin county, and Emmet county, Iowa (common), *Cratty;* common from Jackson county westward and in the Red river valley, *Upham*. South and west.

P. tenue, Michx. Slender Knotgrass.

Lapham. Lake Pepin, *Miss Manning;* rocky hills, Mound, Rock county. *Leiberg;* lake of the Woods, *Dawson.* Rare. South and west.

P. arifolium, L. Halberd-leaved Tear-thumb.

Blue Earth county, *Gedge.* Infrequent.

P. sagittatum, L. Arrow-leaved Tear-thumb.

Common near Stewart river (north shore of lake Superior), and at Minneapolis, *Roberts;* Todd county, etc. (common), *Upham;* Stearns county, *Campbell;* Anoka county, also New Ulm, *Juni.*

P. Convolvulus, L. *Black Bindweed.*

Common, or frequent, throughout the state: troublesome in fields of grain by causing it, when beaten down by wind and rain, to remain so.

P. cilinode, Michx. Polygonum.

Abundant north of lake Superior and in Carlton county, *Juni, Roberts;* upper Mississippi river, *Garrison;* Stearns county, *Mrs. Blaisdell.* North.

P. dumetorum, L., var. **scandens**, Gray. Climbing False Buckwheat.

Common, or frequent, throughout the state.

FAGOPYRUM, Tourn. BUCKWHEAT

F. esculentum, Mœnch. *Buckwheat.*

Occasionally adventive: Minneapolis, and Dakota, Nicollet and Blue Earth counties,

RUMEX, L. DOCK. SORREL.

R. longifolius, DC. Dock.

Hennepin county, *Herrick.* Infrequent. Northwest.

R. Britannica, L. (R. orbiculatus, Gray.) Great Water-Dock.

North of lake Superior (common near Stewart river), *Roberts;* St. Croix river, *Parry:* Isanti county, *Upham;* Stearns county, *Mrs. Blaisdell;* Anoka county, also New Ulm, *Juni;* White Bear lake, Ramsey county, *Kelley;* lake Pepin, *Miss Manning;* Blue Earth county, *Leiberg.*

R. altissimus, Wood. (R. Britannica, L., in *Manual.*) Pale Dock. Peach-leaved Dock.

Upper Mississippi river, *Garrison;* Minneapolis, *Kassube;* Cannon River Falls, *Blake, Sandberg;* lake Pepin, *Miss Manning;* Winona county, *Holzinger;* Blue Earth county, *Leiberg;* Emmet county, Iowa (common), *Cratty.* South.

R. salicifolius, Weinman. White Dock.

Hennepin county, *Herrick;* Kittson county, *Upham;* Pembina, *Chickering, Havard.* [James river, Dakota, *Geyer.*]

R. verticillatus, L. Swamp Dock.

Upper Mississippi river *Garrison;* Isanti county, etc., *Upham;* West Saint Paul, *Miss Butler;* Blue Earth county, *Leiberg;* New Ulm, *Juni.*

R. crispus, L *Curled Dock. Yellow Dock.*

Common, or frequent, throughout the state.

[*R. obtusifolius*, L., will doubtless extend to Minnesota.]

R. sanguineus, L. *Bloody-veined Dock.*

Chaska, Carver county, *Juni.* Rare

R. maritimus, L. Golden Dock.

Minneapolis, *Roberts, Upham;* Chaska, Carver county, *Juni;* Blue Earth county, *Leiberg;* Emmet county, Iowa, (rare), *Cratty;* Murray county, and the Red river valley, *Upham;* Pembina, *Havard.* South and west.

R. Acetosella, L. *Field* or *Sheep Sorrel.* "*Horse Sorrel.*"

Common throughout the state; plentiful all along the north shore of lake Superior, *Roberts, Juni.*

THYMELEACEÆ. MEZEREUM FAMILY.

DIRCA, L. LEATHERWOOD. MOOSE-WOOD.

D. palustris, L. Leatherwood. Moose-wood.

Common northeastward, extending thus west to the lake of the Woods, *Richardson,* White Earth reservation, *Garrison,* and Detroit, *H. B. Ayres,* and south to the Kettle river, *Shumard,* southeastern Pine county, *Upham,* and St. Croix Falls, *Miss Field;* frequent, but local, farther south, as near Minneapolis, *Simmons,* Saint Paul, *Miss Cathcart,* Hastings, *Mrs. Ray,* Faribault, *Miss Beane,* Blue Earth county (common), *Leiberg,* New Ulm, *Juni,* and near the Great spring, Beaver creek, Caledonia, Houston county, *Winchell.*

ELÆAGNACEÆ. OLEASTER FAMILY.

SHEPHERDIA, Nutt. SHEPHERDIA.

S. Canadensis, Nutt. Canadian Shepherdia.

From lake Winnipeg to lake Superior, *Say, Schweinitz;* north shore of lake Superior, *Juni;* Minneapolis (rare), *Miss Butler.* North.

S. argentea, Nutt. Buffalo-Berry.

Rainy lake, *Say, Schweinitz;* upper Minnesota river, *Geyer;* near Walhalla, in northeastern Dakota, *Scott.* Northwest.

ELÆAGNUS, L. OLEASTER.

E. argentea, Pursh.* Silver-Berry.

Common from Ada northward in the Red river valley (forming patches ten to twenty rods long on the prairie, growing only about two feet high, fruiting plentifully; but in thickets becoming five to eight feet high), and local in section 5, Eldorado, Stevens county, *Upham.* Northwest.

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*ELÆAGNUS, L. Flowers perfect. Calyx-tube including the free ovary, the limb cylindric-campanulate or tubular below, parted above into 4 valvate deciduous lobes, colored within. Disk glandulose. Stamens 4, adnate to the calyx and alternate with its lobes, the free portion of the filaments very short; anthers oblong. Style simple, straight; stigma 1-sided. Fruit drupe-like, covered with the thickened dry or fleshy closed calyx-tube; the stone oblong, 8-striate.—Trees or shrubs, with alternate entire petioled leaves and axillary pedicelled flowers.

E. ARGENTEA, Pursh. A stoloniferous unarmed shrub, 6 to 12 feet high, the younger branches covered with ferruginous scales; leaves 1½ to 4 inches long and ¾ to 2¼ inches

SANTALACEÆ. SANDALWOOD FAMILY.

COMANDRA, Nutt. BASTARD TOAD-FLAX.

C. pallida, A. DC.* Bastard Toad-flax.

Red river valley, *Scott*, determined by *Mr. Sereno Watson.* West.

C. umbellata, Nutt. Bastard Toad-flax.

Common throughout the state.

C. livida, Richardson. Bastard Toad-flax.

North shore of lake Superior, *Juni;* Stearns county, *Mrs. Blaisdell.* [Isle Royale (common), *Whitney.*] North.

SAURURACEÆ. LIZARD'S-TAIL FAMILY.

SAURURUS, L. LIZARD'S-TAIL.

S. cernuus, L. Lizard's-tail.

Upper Mississippi river, *Houghton.* Infrequent.

CERATOPHYLLACEÆ. HORNWORT FAMILY.

CERATOPHYLLUM, L. HORNWORT.

C. demersum, L. Hornwort.

White Bear lake, Ramsey county, *Kelley;* lake Calhoun, Minneapolis, *Upham;* small lakes at the Pipestone quarry (var. commune, Gray, with fruit about 3 lines long, tipped with the stout straight style also about 3 lines long, and with a similar short spine, 2 lines long, at the base on each side), *Mrs Bennett.* Probably common throughout the state.

CALLITRICHACEÆ. WATER-STARWORT FAMILY.

CALLITRICHE, L. WATER-STARWORT.

C. verna, L. Water-Starwort.

Throughout the state. North of lake Superior (common), *Roberts;* Pembina, *Havard;* Cottonwood county, *Upham.*

[C. autumnalis, L., probably occurs also in northern Minnesota.]

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wide, broadly or narrowly elliptic, rather acute at each end, or lanceolate and undulate, silvery-scurfy and more or less ferruginous; flowers numerous, deflexed, silvery without, pale yellow within, fragrant, 3 to 5 lines long, the tube broadly oval, the limb funnelform; fruit [silvery in color, like the foliage] globose-ovoid, dry and mealy, edible, 4 or 5 lines in length. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*

*COMANDRA PALLIDA, A. DC. Stems several from a branched woody caudex, herbaceous, striate, erect, 6 to 10 inches high, branching above; leaves alternate, bluish, somewhat punctate on the margins, the lower elliptic oblong, mucronate-acute, 8 to 12 lines long and 2 to 3 lines wide, the uppermost usually linear-lanceolate, 5 to 10 lines long and about 1 line wide, sometimes so continued down the stem (forming var. angustifolia); cymes terminal, few-flowered; bracts linear-lanceolate, 2 lines long; flowers perfect; calyx-lobes erect-spreading; fruit 3 lines in diameter, with subfleshy epicarp.—Flowers precisely as in C. umbellata; distinguished especially by its narrowed upper leaves and much larger fruit. *Watson's Rep. in King's Expl. of the Fortieth Parallel*

PODOSTEMACEÆ. River-weed Family.

PODOSTEMON, Michx. River-weed.

P. ceratophyllus, Michx. River-weed.

Lake Pepin, *Miss Manning*. Rare.

EUPHORBIACEÆ. Spurge Family.

EUPHORBIA, L. Spurge.

E. polygonifolia, L Shore Spurge.

Lapham. Shore of lake Superior; lake Pepin, *Miss Manning*.

E. Geyeri, Engelm. Geyer's Spurge.

Lapham, T. J. Hale. Common at Minneapolis, *Upham, Simmons.*

E. serpyllifolia, Pers. Thyme-leaved Spurge.

Minneapolis, *Herrick;* Blue Earth county, *Leiberg;* Martin county, *Gedge;* New Ulm, *Juni;* Murray county, *Upham;* Stearns county, *Mrs. Blaisdell;* Pembina, *Havard.*

E. glyptosperma, Engelm. Spurge.

Minneapolis, *Herrick;* Saint Cloud, *Campbell;* Red river valley, *Scott.*

E. maculata, L. Spotted Spurge.

Common through the south half of the state and perhaps northward.

E. humistrata, Engelm. Spurge.

Minneapolis, *Roberts;* Winona county, *Holzinger;* Martin county, *Gedge.* South.

E. hypericifolia, L Spurge.

Waste, dry places. St. Croix river, *Parry;* Minneapolis, *Roberts;* lake Pepin, *Miss Manning;* Winona county, *Holzinger;* Blue Earth county, *Leiberg.* South.

E. marginata, Pursh. White-margined Spurge. "Mountain Snow."

Frequent, often common, southwestward; extending northeast to Redwood Falls (found to be poisonous to the touch, even in mounting dried specimens), *Miss Butler;* in Lyon county becoming a common weed in cultivated fields, *Upham.*

E. corollata, L. Flowering Spurge.

Frequent, often common, through the south half of the state.

E. heterophylla, L. Spurge.

Spirit lake, Minnesota river, etc., *Geyer;* Blue Earth county, *Leiberg, Gedge;* Minneapolis, *Twining, A. W. Jones;* Goodhue county, *Sandberg;* lake Pepin, *Miss Manning.* South.

E. dictyosperma, Fischer & Meyer. Spurge.

Rock county, *Leiberg.* Southwest.

E. Cyparissias, L. *Garden Spurge.*

Adventive: Mankato, *Leiberg;* Goodhue county, *Sandberg;* lake Pepin, *Miss Manning.*

[E. commutata, Engelm., should be looked for in this state.]

ACALYPHA, L. Three-seeded Mercury.

A. Virginica, L. Three-seeded Mercury.

Minneapolis. *Roberts;* Blue Earth county, *Leiberg;* lake Pepin, *Miss Manning.*

EMPETRACEÆ. CROWBERRY FAMILY.

EMPETRUM, Tourn. CROWBERRY.

E. nigrum, L. Black Crowberry.

North shore of lake Superior, *Macoun*; doubtless in northern Minnesota.

URTICACEÆ. NETTLE FAMILY.

ULMUS, L. ELM.

U. fulva, Michx. Slippery or Red Elm.

Frequent, often common, throughout the state, excepting far northward. Well known for its mucilaginous, medicinal inner bark; the reddish wood, used for ox-yokes, posts, etc., is strong, light and durable.

U. Americana, L. White Elm. Amercian Elm. Water Elm.

Common throughout the state; but not found close to the shore of lake Superior. Wood tough. often used for axe-helves, whip-stocks, etc.; our most desirable tree for transplanting for ornament and shade. This and basswood are the most abundant trees in the Big Woods.

U. racemosa, Thomas. Corky White Elm. Rock Elm.

Frequent, often common, eastward; extending west to Blue Earth county, *Leiberg*, Nicollet county, *Aiton*, New Ulm (common), *Juni*, and the upper Mississippi river, *Garrison*. Wood drier than the last and more valuable; much used by wheelwrights.

CELTIS, Tourn. NETTLE-TREE. HACKBERRY.

C. occidentalis, L. Sugarberry. Hackberry.

Frequent through the south half of the state; rare and local northward, as at the east side of Mille Lacs and at lake Alexander, *Upham;* near lake Lida, Otter Tail county, *Frazee;* on the Red river in Clay county; at Red Lake Falls; on the upper Mississippi; and on the Big Fork of Rainy Lake river, in T. 149, R. 26, *Hinchelwood*. [Also at Eagle lake, north of Rainy lake, *Bell*, *Macoun;* and in northeastern Dakota, *Scott*.]

MORUS, Tourn. MULBERRY.

M. rubra, L. Red Mulberry.

Big Woods, *Winchell;* Houston county, *J. S. Harris*. [West to Dakota, *Sargent*, and eastern Nebraska, *Aughey*.] Infrequent. South.

URTICA, Tourn. NETTLE.

U. gracilis, Ait. Tall Wild Nettle.

Common throughout the state.

U. dioica, L. *Great Stinging Nettle*.

Upper Mississippi river, *Garrison;* lake Pepin, *Miss Manning*. Rare.

LAPORTEA, Gaud. WOOD-NETTLE.

L. Canadensis, Gaud. Wood-Nettle.

Common through the south half of the state and in the Red river valley; extending northeast to the upper Mississippi river and Roseau river. "It is of this plant the Indians usually make their fishing lines, the rotted remains of the previous year's growth furnishing an abundant supply." *Parry*.

PILEA, Lindl. RICHWEED. CLEARWEED.

P. pumila, Gray. Richweed. Clearweed.

St. Croix river, *Parry;* Minneapolis, *Simmons;* lake Minnetonka (common), *Roberts;* Blue Earth county, *Leiberg;* Fergus Falls, *Leonard.* South.

BŒHMERIA, Jacq. FALSE NETTLE.

B. cylindrica, Willd. False Nettle.

Lapham. Fergus Falls, *Leonard.* Infrequent.

PARIETARIA, Tourn. PELLITORY.

P. Pennsylvanica, Muhl. Pellitory.

Minneapolis (presenting, besides the type, a larger and much branched form), *Herrick, Simmons;* Blue Earth county, *Leiberg;* and northwest to the upper Missouri and Saskatchewan rivers. Infrequent. South and west.

CANNABIS, Tourn. HEMP.

C. sativa, L. *Hemp.*

A common or frequent weed.

HUMULUS, L. HOP.

H. Lupulus, L. Common Hop.

Common, especially northward; "native on all the tributaries of the upper Mississippi," *Parry.*

PLATANACEÆ. PLANE-TREE FAMILY.

PLATANUS, Tourn. PLANE-TREE. BUTTONWOOD.

P. occidentalis, L. American Plane-tree. Buttonwood. Sycamore.

Lapham. Southeast, rare. The northwest limit of this species scarcely enters Minnesota.

JUGLANDACEÆ. WALNUT FAMILY.

JUGLANS, L. WALNUT.

J. cinerea, L. Butternut. Oil-nut. White Walnut.

Common southward, but absent far southwest; extending north to the Snake river in Pine and Kanabec counties, *Norwood, Upham,* and on the Mississippi river to the north line of Aitkin county, *Garrison.* Wood valuable for cabinet work and in house-building for inside finishing

J. nigra, L. Black Walnut.

Frequent in the south part of the state; extending north to Ninînger, Dakota county, southern Scott and Carver counties, and to Walnut Grove in the south edge of Redwood county. Because of the great value of its lumber, nearly all the black walnut of large size in this state has been cut; but much of young growth remains.

CARYA, Nutt. HICKORY.

C. alba, Nutt. Shell-bark or Shag-bark Hickory. "Walnut."

Common, or frequent, in Houston county; extending north into Winona county at least to Winona and Stockton, and west (rare) into Fillmore, Mower and Freeborn counties, to Moscow, *Winchell;* near Weaver and Kellogg, Wabasha county, and near Chatfield, on the south line of Olmsted county, *W. D. Hurlbut.* Southeast. "Timber very valuable, used wherever great durability, strength and elasticity are required."

C. porcina, Nutt. Pig-nut or Broom Hickory.

Lapham. Southeastward, extending north to Snake river, *Clark;* near lake Pepin on the Wisconsin side, *Mrs. Ray.*

C. amara, Nutt. Bitter-nut or Swamp Hickory.

Common, or frequent, southward; extending through the Big Woods, and north to Mille Lacs, and sparingly to the upper Mississippi river, and to Whiteface river, tributary to the St. Louis river. This species furnishes nearly all the hoop-poles for flour-barrels cut in the southern and central portions of the state.

CUPULIFERÆ. OAK FAMILY.

QUERCUS, L. OAK.

Q. alba, L White-Oak.

Frequent, or common, in the southeast and central parts of the state; extending north to Fond du Lac, *Clark,* Savannah river, and Squagemaw lake, *Winchell,* and to Pokegema falls, Pemidji lake (plentiful in many places on the upper Mississippi river), and the White Earth reservation, *Garrison.* "Strong, durable, and beautiful timber."

Q. stellata, Wang. (Q. obtusiloba, Michx.) Post-Oak. Rough or Box White-Oak.

Upper Mississippi river, *Houghton.* Infrequent.

Q. macrocarpa, Michx. Bur-Oak. Over-cup or Mossy-cup White-Oak.

Common, or abundant, throughout the state, excepting far northeastward. Its northeastern limit north of lake Superior, according to *Bell,* is near the international boundary; but he states that it attains a good size on the Rainy river and thence westward. ("In going west, this species is first met with at the east end of Eagle lake" [north of Rainy lake], *Macoun.*) Timber valuable, similar to that of white oak.

Q. bicolor, Willd. Swamp White-Oak.

Frequent in Benton, Mille Lacs and Morrison counties, and thence north to lake Winnibigoshish and the White Earth reservation, *Garrison.*

Q. Muhlenbergii, Engelm. (Q. Prinus, L., var. acuminata, Michx.) Yellow Chestnut-Oak.

Lapham. Southeast.

Q. tinctoria, Bartram. (Q. coccinea, Wang., var. tinctoria, Gray.) Black Oak. Quercitron or Yellow-barked Oak.

Common, or abundant, southward; extending north to Pine county, *Upham,* and to Pokegama falls and the White Earth reservation, *Garrison;* the most abundant species of oak in the southeast part of the state. This species and the bur oak vary from 20 to 50 or 60 feet in hight, according to their situation and soil; besides which, each occurs frequently dwarfed, growing as scrubby brush from 3 to 10 feet high.

Q. coccinea, Wang. Scarlet Oak.

Upper Mississippi river, *Garrison;* "in Minnesota (*Engelmann*)." *Sargent.*

Q. coccinea, Wang., var. **ambigua,** Gray. Gray Oak.

Prairie river, attaining a hight of 50 feet and diameter of 10 inches, *Clark;* White Earth reservation, *Garrison.* North

Q. rubra, L. Red Oak.

Occasional southward, and north to the upper Mississippi river, *Geyer, Garrison;* continuing on the north side of lake Superior to the Kaministiquia river, *Bell, Macoun.*

In autumn the leaves of the black and red oaks change to red and crimson colors; while the foliage of the white and bur oaks changes only to dull green, gray and brown. At the same time the leaves of the sumachs and red maple become red or scarlet; of the sugar maple, yellow; and of bass, box-elder, ash trees, elms, poplars, and cottonwood, various shades of brown and yellow.

Q. palustris, Du Roi. Swamp Spanish Oak. Pin Oak.

Lapham. Upper Mississippi river, *Garrison.*

[*Sargent* and *Bell* have mentioned Minnesota as a western limit of the American beech (Fagus ferruginea, Ait.), but it probably does not extend into this state.]

CORYLUS, Tourn. HAZEL-NUT. FILBERT.

C. Americana, Walt. Common Wild Hazel-nut.

Common, in many districts abundant, throughout the state.

C. rostrata, Ait. Beaked Hazel-nut.

Common northward; extending south to Benton county and Spruce Hill, Douglas county, *Upham;* rare and local farther south, as on rocky bluffs in southeastern Winona county, *Winchell. Juni* says of this species north of lake Superior: "In some places the bushes reach a hight of fifteen feet, with stems from one to one and a half inches in diameter. The tops bend over from the weight of the fruit."

OSTRYA, Micheli. HOP-HORNBEAM. IRON-WOOD.

O. Virginica, Willd. American Hop-Hornbeam. Iron-wood. Lever-wood.

Common, often abundant, throughout the state; but not close to the shore of lake Superior.

CARPINUS, L. HORNBEAM. IRONWOOD.

C. Caroliniana, Walt. (C. Americana, Michx.) American Hornbeam. Blue or Water Beech.

Common through the south half of the state; extending north to Pine county and Sandy lake, *Clark,* the Savannah portage, *Winchell,* and White Earth reservation, *Garrison.* "Wood of this and the preceding tough and durable; used for wedges, levers, &c."

MYRICACEÆ. SWEET-GALE FAMILY.

MYRICA, L. BAYBERRY. WAX-MYRTLE.

M. Gale, L. Sweet Gale.

Common on lake-shores, along the international boundary, between lake Superior and Rainy lake, *Winchell.* North.

COMPTONIA, Solander. SWEET-FERN.

C. asplenifolia, Ait. Sweet-Fern.

Frequent northeastward; extending south to Snake river in southeastern Pine county, *Upham,* and southwest to Cass lake, *Schoolcraft;* it also occurs at Jacob Streitz's quarry in section 28, Saint Cloud, *Upham,* and near Excelsior, Hennepin county, *Mrs. Terry.*

BETULACEÆ. Birch Family.

BETULA, Tourn. Birch.

[B. lenta, L. (cherry birch, sweet or black birch) possibly extends west to northern Minnesota. *Dr. Bell* mentions this state as its northwestern limit. Some of the more northern references under B. nigra may belong instead to this species.]

B. lutea, Michx. f. Yellow or Gray Birch.

Common through the north half of the state and south to Sherburne county, reaching a hight of 75 feet and diameter of 3 or 4 feet; rare in the Big Woods, and southeast to Houston county, *Winchell*. "The 49th parallel forms the average northern limit of this species from Newfoundland to the Red river valley, in which it curves round and runs southward." *Bell.*

B. papyracea, Ait. Paper or Canoe Birch. Silver Birch.

Common, often abundant, through the north half of the state, attaining an equal size with the preceding; also common, but much smaller, southeastward near the Mississippi river; thence extending west, less frequent, to the Big Woods, and to Birch Cooley (plentiful), Renville county; absent southwestward; "found along the Assiniboine valley as far west as the Qu'Appelle lakes," *Bell.* "The bark of this tree, together with that of the Arbor-vitæ, is made use of in innumerable ways by the Indians." *Roberts.*

B. nigra, L. River or Red Birch.

Savannah portage, *Douglass;* White Earth reservation, *Garrison;* Kettle river, *Shumard;* Blue Earth county, *Nicollet;* Winona county, *Holzinger;* abundant along the Mississippi bottoms at least as far north as Minneiska, Wabasha county, *Winchell.* Southeast.

B. pumila, L. Low Birch. "Tag Alder."

Common through the north half of the state, and south to Minneapolis and Saint Paul: less frequent or rare farther south, to lake Pepin, *Miss Manning*, and Olmsted county, *Harrington.*

B. glandulosa, Michx. Dwarf Birch.

Savannah river, *Houghton;* north shore of lake Superior, *Juni, Winchell;* ridge east of the Red river, *Scott.* North.

ALNUS, Tourn. Alder.

A. viridis, DC. Green or Mountain Alder.

North of lake Superior (common), *Juni, Roberts.* North.

A. incana, Willd., var. **glauca**, Regel. Speckled or Hoary Alder. Black Alder.

Common, or frequent, through the north half of the state, and southeastward to Minneapolis; less frequent thence southeast; rare southwestward.

A. serrulata, Ait. Smooth Alder.

Lapham, Winchell. Rare. Southeast.

SALICACEÆ. Willow Family.

SALIX, Tourn. Willow. Osier.

S. candida, Willd. Hoary Willow.

Throughout the state, excepting far southward. Bogs, St. Croix river, *Parry;* Minneapolis, *Kassube;* Blue Earth county, *Leiberg;* New Ulm, *Juni;* north of lake Superior, *Agassiz;* upper Mississippi river, *Garrison*; Red river valley, *Macoun*.

S. tristis, Ait. Dwarf Gray Willow.

Lapham. Minneapolis, *Winchell;* Blue Earth county, *Leiberg;* Lake City, *Mrs. Ray*.

S. humilis, Marshall. Prairie Willow.

Blue Earth county, *Leiberg, Upham;* frequent in Emmet county, Iowa, *Cratty;* abundant near the Mississippi river, on dry, sandy land, especially in openings of woods, from lake Pepin, *Miss Manning, Mrs. Ray,* and Ramsey county, north at least to Brainerd (usually only about one foot high, agreeing best, excepting in habitat, with Gray's description of S. tristis), *Upham;* north of lake Superior, *Agassiz*. Probably throughout the state.

S. discolor, Muhl. Glaucous Willow. Pussy Willow.

Common, or frequent, throughout the state.

[S. sericea, Marshall, probably occurs, but infrequently, in Minnesota.]

S. petiolaris, Smith.* Petioled Willow.

Freeborn county (frequent), *Upham*. Probably our prevailing form of this species is var. GRACILIS, Anders. (*M. S. Bebb.*)

S. purpurea, L. *Purple Willow.*

Minneapolis, *Simmons*. Infrequent.

S. cordata, Muhl. Heart-leaved Willow.

Common, or frequent, throughout the state.

S. cordata, Muhl., var. **angustata,** Gray.

Stearns county, *Garrison*. [North of lake Superior, *Agassiz;* Nebraska (common), *Aughey*.]

S. balsamifera, Barratt.† (S. pyrifolia, Anders.; see notes by *M. S. Bebb* in *Botanical Gazette*, vol. iv, p. 190.) Balsam-bearing Willow.

Red river valley near Saint Vincent, *Burgess, Macoun*. North.

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*SALIX PETIOLARIS, Smith, var. GRACILIS, Anders. Female aments gracefully subpendulous, at length somewhat leafy-peduncled, very loosely flowered ; scales lingulate, apex brownish ; capsules long acute-rostrate from an ovate base, thinly silky, or somewhat glabrous, very long-pediceled ; pedicel nearly eight times the length of the nectary; style very short ; stigmas 2-parted, fuscous, spreading ; leaves narrowly lanceolate-linear, serrulate, about 2 inches long and 2 to 4 lines wide, pale and subglaucous beneath, both sides at length glabrous. Varies : 1st, sericocarpa ; capsules narrowly conical, 2½ lines long, thinly silky. 2d, leiocarpa ; capsules thick at base, greenish red. *Andersson* in *DC. Prod.*, 16, 2, 235 ; translated by *M. S. Bebb*.

†SALIX BALSAMIFERA, Barratt. A glabrous, much branched shrub, 4 to 8 feet high ; twigs crimson where exposed to the sun ; leaves ovate, abruptly pointed, 1 inch wide by 1⅓ inches long, on sterile shoots oblong-lanceolate, 1½ inches wide by 3 to 4 inches long, all rounded or subcordate at base, very thin and slightly hairy beneath when young, rigid, glabrous, and prominently reticulate-veined when mature, bright green above, paler or glaucous beneath, margin finely glandular-serrate; petioles slender, ½ inch long ; stipules minute, caducous : aments with a few leaf-like bracts at base, the male densely flowered, very silky, female less so and becoming very lax in fruit, bracts often more leafy ; scales pale or rosy ; capsules elongate-conical or rostrate from a thick base, 2 or 3 lines long, glabrous, the long pedicels six to eight times the length of the nectary ; style rather short, bifid ; lobes of the stigma thick, spreading, emarginate. "No. 53, Herb. H., B. and T." (v. s. in h. Torr.) S. cordata, Muhl., var. balsamifera, Hook., *Fl. Bor.-Am.*, 2, 149. S. pyrifolia, Anders., *DC. Prod.*, 16, 2, 264.—White mountains of N. H., *Pringle;* New Brunswick. *Fowler;* and Labrador, *Allen;* westward to the Saskatchewan. Readily distinguished from S. cordata by the very loosely flowered fertile aments, often two inches or more long in fruit, thicker and more yellowish staminate aments, and the proportionately broader and shorter Amelanchier-like leaves. *M. S. Bebb, MSS.*

S. rostrata, Richardson. S. livida, Wahl., var. occidentalis, Gray. Beaked Willow. Livid Willow.

Common throughout the state.

S. lucida, Muhl. Shining Willow.

Common or frequent, throughout the state.

S. nigra, Marshall. Black Willow.

Throughout the state; frequent northward, common southward. This and the next are our only native species of willow that become trees, the others being shrubs.

S. amygdaloides, Anders.* Almond-leaved Willow.

Red river and eastward, *Bebb;* probably frequent throughout the state.

S. *fragilis*, L. × *alba*, L. *White Willow.*

Occasionally spontaneous; much cultivated, especially on the prairies, for shade and protection from the wind. Timber culture, of this tree, red and sugar maple, box-elder, cottonwood, Lombardy poplar, and other species, is being begun extensively in the prairie region, chiefly for the rewards provided by laws of the state and United States governments. The white willow is well adapted to yield fuel, as it grows rapidly, and, when cut down, shoots up vigorously anew from the stump. In good soil, with good care, probably ten acres of this willow would supply an average household with fire-wood continually.

M. S. Bebb regards this "white willow," commonly planted (by cuttings) for screens, as a hybrid of *S. fragilis* and *S. alba*, being apparently the form named *S. fragilis*, L., var. *Russelliana*, Carey, in Gray's *Manual*. Mr. Bebb writes: "Among the varieties cultivated throughout the Northwest, I have seen no genuine *S. alba*. In one form, *S. fragilis* × *alba*, var. (c) *vitellina*, Wimmer (*S. palustris*, Host.), the leaves approach very near to *S. alba*, var. *cærulea*, but the flowers are different. Much the more commonly planted form is *S. fragilis* × *alba*, var. (b) *glabra*, Wimmer (exactly *S. excelsior*, Host.; *S. viridis*, Fries, when the under surface of the leaf is pale green)."

S. longifolia, Muhl. Long-leaved Willow. Sand-bar Willow.

Common throughout the state.

S. myrtilloides, L. Myrtle Willow.

Frequent northward, rare southward. Swamps, St. Croix river, *Parry;* north of lake Superior, *Agassiz;* Kanabec and Benton counties, *Upham;* Dellwood, White Bear lake, Ramsey county, *Kelley;* Minneapolis, *Kassube;* near Eagle lake, Blue Earth county, *Leiberg;* Emmet county, Iowa (rare), *Cratty*.

POPULUS, Tourn. POPLAR. ASPEN.

P. tremuloides, Michx. American Poplar or Aspen.

Common, or abundant, throughout the state, especially northward. Wood of this and the next is valuable for paper-making.

P. grandidentata, Michx. Large-toothed Poplar or Aspen.

Common, or frequent, throughout most of the state; excepting the southeastern

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*SALIX AMYGDALOIDES, Anders. Leaves broadly lanceolate, 3 to 6 inches long, ½ to 1½ inches wide, with a long tapering point, glaucous beneath, closely serrate, petioles long and slender, stipules minute and very early deciduous: aments leafy-peduncled, elongated-cylindrical, pendulous; the fertile when in fruit lax, 3 to 4 inches long, ½ inch thick; scales in the male ament ovate, villous with crisp hairs, in the female narrower, somewhat smooth, fugacious: capsules globose-conical, glabrous, long-pedicelled; style very short or obsolete, stigmas notched. . . . In aspect very unlike S. nigra [like which, this species attains a tree-like size], and in fact more frequently mistaken for S. lucida. The broad leaves, being supported by long and slender petioles, are moved by the slightest breeze, displaying in rapid, fluttering succession their conspicuous white under surfaces, thus producing an effect in striking contrast with the changeless, soft light reflected from masses of the foliage of S. nigra when swayed gently by the wind. *Bebb* in *Wheeler's Report of Surveys west of the One Hundredth Meridian.*

counties and far northward, where it occurs sparingly, and southwestward, where it is absent.

P. monilifera, Ait. (Including P. angulata, Ait.) Cottonwood. Necklace Poplar.

Common, or frequent, through the south half of the state; rare farther north; reaching its northern limit in southeastern Pine county, the region of the upper Mississippi, *Houghton*, White Earth reservation, *Garrison*, and Red Lake Falls and the Red river valley, *Upham*. "Large trees occur along the Assiniboine river," *Bell*. "Extensively planted for shelter and fuel. The cotton from the seeds proves a source of much annoyance to the tidy housewife. If only male trees, those with reddish tassels, were planted, no cotton would be produced. Both kinds of tassels, the green and the red, appear in spring before the leaves come out." *Arthur*.

P. balsamifera, L. Balsam Poplar. Tacamahac.

Common, or frequent, through the north half of the state; extending southwest to Cannon river (rare), *Sandberg*, Osakis lake, *Upham*, and Fergus Falls, *Leonard*.

P. balsamifera, L., var. **candicans,** Gray. Balm of Gilead.

Frequent northeastward; extending southwest to southeastern Pine county, Little Falls, and White Earth reservation.

P. dilatata, Ait. *Lombardy Poplar.*

Spontaneous, Mankato, *Leiberg*. [Stiff spiry tree, with closely appressed branches, and small broadly triangular pointed leaves; formerly much planted. *Gray's Field, Forest, and Garden Botany.*]

P. alba, L. *White Poplar. Silver-leaf Poplar. Abele. Abel-tree.*

Cultivated, and thence sometimes spreading spontaneously, in Martin county, *Cratty*. [Tree planted from Europe, with spreading branches, roundish, slightly heart-shaped wavy-toothed or lobed leaves soon green above, very white cottony beneath; buds not glutinous: spreads inveterately by the root. *Gray's Field, Forest, and Garden Botany.*]

CONIFERÆ. PINE FAMILY.

PINUS, Tourn., Link. PINE.

P. Banksiana, Lambert. "Jack Pine." Gray or Northern Scrub Pine. Banks' or Banksian Pine. Black Pine.

Common northeastward; abundant on sandy land in the region of the upper Mississippi and Crow Wing rivers, from Brainerd and Wadena northward; having its southwest limit at the St. Croix and Snake rivers, Princeton, Brockway (Stearns county), Stowe and Oak Valley (ten miles south of Wadena), in the White Earth reservation, and at the lake of the Woods and on Roseau river. This species, almost alone, but with red pines here and there sparingly intermixed, forms thick woods at many places in Cass, Wadena and Crow Wing counties, as, for example, at Brainerd, growing very straight and slender, 40 to 60 feet in hight, but seldom exceeding a foot in diameter. Its coarse, resinous wood is excellent fuel, but it is not adapted to building purposes. Many railroad ties are made from this and the next species of pine, but are inferior in value and durability to those of bur oak, which are more used in this way. Often five ties, each eight feet long, are obtained from a single Jack pine. Rarely this tree attains a hight of eighty feet, one of this size being found by *Professor Winchell* on Brule mountain, north of lake Superior. [This tree grows sixty to seventy feet high in northern Michigan (*Wheeler and Smith's Catalogue*, and *Bulletin of the Torrey Botanical Club*, x, 82); and *Dr. Bell* records it as about seventy feet in hight and two feet in diameter, in large groves, on the southern branches of the Albany river.]

P. resinosa, Ait. "Norway Pine." Red Pine.

Common or frequent northward, growing in groves, or scattered, on somewhat sandy land; not extending, in general, quite so far southwest as the preceding. Usually called "Norway pine"; but wrongly, for this species is not found in Norway, nor in Europe. It is mostly from 50 to 75 feet high, but seldom more than about a foot in diameter. *Clark* reports that it attains a hight of 80 feet and diameter of 20 inches, north of lake Superior. It is considerably sawn for lumber, and is also much used for piles, as for wharves and foundations of bridge piers. In the region of the upper Mississippi this species is reported by *Garrison* as occurring in two varieties, which are distinguished by lumbermen under the names Hard Norway pine and Red-barked Norway pine

P. Strobus, L. White Pine.

Common through the north half of the state, excepting west of Red lake and the lake of the Woods; preferring somewhat clayey land, occasionally making a majestic forest without intermixture of other large trees, but oftener associated with maple, elm, bass, oak, ash, and other deciduous species; frequent along the north side of lake Superior, but forming no extensive pine forest on the immediate shore. This is the largest, as well as the most useful, of our trees, growing from 80 to 125, rarely 150, feet in hight, and from three to six feet in diameter.

The southwestern limit of the pineries extends from the north edge of Chisago county westerly through Kanabec and Mille Lacs counties, the northeast corner of Benton county, Morrison county, and northeastern Todd county, to Pine lakes, Frazee City, and the White Earth reservation; but only a comparatively small part of the region northeast of this line is covered with pine woods. Southeastward, beyond this limit, white pine occurs rarely and locally in the vicinity of the Mississippi, St. Croix, Cannon, Zumbro and Root rivers, in most instances on bluffs of these or their tributary streams: as at Saint Cloud, Dayton, Minnehaha falls, Pine Bend, Taylor's Falls, Franconia (where it was first cut in Minnesota, to any considerable extent, for lumber), near Cannon River Falls, near Mantorville, near Rochester, in section 29, Saint Charles, Winona county, and at various points in Fillmore and Houston counties.

Mr. Platt B. Walker, of Minneapolis, editor of the *Lumberman and Manufacturer*, states that approximately 400,000,000 feet board-measure) of pine are annually cut in the north central part of this state, on the Mississippi river and its tributaries, about three-quarters of which are sawed at Minneapolis; and that some 200,000,000 feet are annually cut on the St. Croix river and its branches, about half of which is cut in Minnesota, chiefly on the Snake river, the amount sawed at Stillwater being some 100,000,000 feet yearly. Throughout these districts about three-quarters of the timber cut are white pine, and the remainder red or Norway pine. Much white pine is also cut on the St. Louis river, the Otter Tail river, Clearwater river (a tributary of Red Lake river), and recently on the Rainy Lake river; and red pine is cut on Pine creek, tributary to Roseau lake and river, west of the lake of the Woods.

The amount of merchantable pine standing in Minnesota in 1880 was estimated by *C. S. Sargent*, special agent of the United States census, at 6,100,000,000 feet; and the amount cut in the state during the preceding year is reported to be 540,997,000 feet.

PICEA, Link. SPRUCE.

P. nigra, Link. (Abies nigra, Poir.) Black Spruce. Double Spruce.

Common northeastward; extending south to Chisago and Isanti counties, and west to Spruce Hill, Douglas county, the White Earth reservation, Red lake, and the lake of the Woods and Roseau river. It attains, in favorable situations, a hight of 70 feet and diameter of 18 inches, *Clark*; but usually it is small, and none of it is cut for lumber in this state.

P. alba, Link. (A. alba, Michx.) White Spruce. Single Spruce.

Common far northward; extending south to Moose Lake, Carlton county, *Upham*, and to the upper Mississippi river and White Earth reservation, *Garrison*, and west to the lake of the Woods and Roseau river; 20 feet high, 8 inches in diameter, *Clark*.

TSUGA, Carrière. HEMLOCK-SPRUCE.

T. Canadensis, Carrière. (Abies Canadensis, Michx.) Hemlock-Spruce. Hemlock.

Mentioned by *Nicollet* as observed in the region of the upper Mississippi, and by

Norwood in the valley of the St. Louis river ; included in *Dr. Lapham's* catalogue ; also reported as occurring, locally, near Pokegama lake, Cass county, and at the north side of Sand lake, in the southwest part of T. 46, R. 19, Carlton county, and in other parts of this county, as on Black Hoof creek ; all of which need verification. Though plentiful not far eastward in Wisconsin, it extends very scantily, if at all, into Minnesota. ["On the south shore of lake Superior it does not reach the western extremity, turning southward in the neighborhood of Ashland. I am informed, however, that there is an outlying grove of hemlock at Thomson, about twenty-five miles west of Duluth. This tree maintains a good size to the verge of its range, and always appears to terminate abruptly." *Bell.*]

ABIES, Link. FIR.

A. balsamea, Marshall. Balsam Fir.

Common northeastward, attaining a hight of 50 feet, *Clark;* extending south and west to nearly the same limits as the black spruce ; also farther south, rare and local, as near Mantorville, Dodge county, *Harrington*, and in the heavy timber in the northeast part of Spring Valley, Fillmore county, *Winchell.*

LARIX, Tourn. LARCH.

L. Americana, Michx. American or Black Larch. Tamarack. Hackmatack.

Abundant through the north half of the state, and common southeast to Wright, Hennepin and Ramsey counties ; rare farther southeast, as on Pine creek in Houston county, *Winchell;* absent southwestward. This tree occurs in swamps, which are generally frequent, varying in extent from a few rods to several miles. *Mr. Nathan Butler* states that such swamps, bearing tamarack but scarcely any other trees, occupy nearly the entire country between Red lake and the lake of the Woods ; and *Mr. G. M. Dawson* and others give a similar description of the area crossed by the international boundary between the lake of the Woods and the Red river valley. Tamarack also often grows on drier, hard ground ; sometimes, north of lake Superior, attaining a hight of 90 or 100 feet (but very slender, having a diameter of only about one foot ; valuable for railroad ties), *Clark.* Its usual hight is from 20 to 40 feet.

Watab river and township bear the name which the Chippewas give to the long threads obtained by splitting tamarack roots, used by them in sowing their birch canoes. *Keating's Narrative of Long's Expedition*, vol. ii, p. 73.

THUYA (Thuja), Tourn. ARBOR VITÆ.

T. occidentalis, L. American Arbor Vitæ. "White Cedar."

Common northeastward, forming almost impenetrable "cedar swamps," often attaining a large size, from 40 to 70 feet in hight, and from one to two or even three feet in diameter, *Clark, Roberts*; extending west to the south end of lake Winnipeg, *Bell*, the lake of the Woods and Roseau river, Red and Pemidji lakes, and to the head of Straight river in northeastern Becker county, and south to the south shore of Mille Lacs and the mouth of Snake river. It also occurs very rarely farther southeast, as on Gwinn's bluff in southeastern Winona county, *Winchell.* On the north shore of lake Superior, "not so common as inland, but maintains its hold upon life in the most unfavorable positions. Often the only representative of the vegetable kingdom on a bare rock in the lake, where its stem and branches plainly indicate the direction of the prevailing winds and waves." *Juni.* This tree is the principal species upon a large area adjoining the Mississippi river in northern Aitkin county. Its wood is light and very durable, being especially sought for fence and telegraph posts. It is often spiral-grained.

JUNIPERUS, L. JUNIPER.

. communis, L. Common Juniper.

Throughout the state, but infrequent. Minnesota Point, near Duluth (plentiful), also near Minneapolis, *Roberts;* Wadena and Benton counties (rare), *Upham;* Sherburne and Ramsey counties, *Kelley;* Hennepin county, *Simmons;* Goodhue county, *Sandberg;* southeastern Winona county, *Winchell;* Dodge county, *Harrington;* Blue Earth county, *Leiberg;* bluffs of the Cottonwood river, *Juni.*

J. communis, L., var. **alpina,** Gaud. Juniper.

North shore of lake Superior, *Juni;* Taylor's Falls, *Miss Cathcart.* North.

J. Virginiana, L. Red Cedar. Red Savin.

Rainy Lake river, *Dawson;* upper Mississippi (rare), *Nicollet, Garrison;* lake Pepin, *Miss Manning;* bluffs of the Cottonwood river, *Juni;* at Redwood Falls, perhaps furnishing the name of the Redwood river. (Also see Cornus stolonifera.) Found scantily in exposed situations, as on the bluffs or shores of rivers and lakes, growing to be 10 to 25 feet high, in the greater part of the state; most frequent in its southeast quarter; absent, or rare, near its west side and north of lake Superior.

J. Sabina, L., var. **procumbens,** Pursh. Savin. Juniper.

Lake of the Woods, *Dawson;* plentiful on dunes at Sand Hill river, Garfield, Polk county, *Upham;* near Itasca lake, *Garrison;* Rice county, *Sperry;* bluffs of Le Sueur river, *Leiberg;* Olmsted county (rare), *Harrington;* the Big Woods, and Fillmore, Winona and Houston counties (rare), *Winchell.* North.

TAXACEÆ. Yew Family.

TAXUS, Tourn. Yew.

T. Canadensis, Willd. (T. baccata, L., var. Canadensis, Gray.) American Yew. Ground Hemlock.

Abundant north of lake Superior, *Juni, Roberts;* common, or frequent, thence west and south to nearly the same limits as the pines, black spruce and balsam fir; near Lake City, *Mrs. Ray.*

ARACEÆ. Arum Family.

ARISÆMA, Martius. Indian Turnip. Dragon-Arum.

A. triphyllum, Torr. (A. atrorubens, Blume. *Bot. Gazette,* ix, 114.) Indian Turnip. Jack-in-the-Pulpit.

Common, or frequent, throughout the state.

A. Dracontium, Schott. Green Dragon. Dragon-root.

Lake Pepin, *Miss Manning.* Rare. Southeast.

CALLA, L. Water Arum. Calla.

C. palustris, L. Water Arum. Wild Calla.

Common in the north half of the state, and southeast to Minneapolis and Saint Paul; rare farther southeast, as near lake Pepin, *Miss Manning;* absent southwestward.

SYMPLOCARPUS, Salisb. Skunk Cabbage.

S. fœtidus, Salisb. Skunk Cabbage.

Chisago county, etc. (common), *Upham;* Stillwater, *Miss Field;* Saint Paul, *Kelley;* near Minnehaha falls, *Roberts;* lake Pepin, *Miss Manning;* Winona county, *Holzinger;* New Ulm, *Juni.* [Hesper, Iowa, *Mrs. Carter;* lake Superior, *Whitney.*]

ACORUS, L. Sweet Flag. Calamus.

A. Calamus, L. Sweet Flag. Calamus.

Common, or frequent, throughout the state; excepting perhaps southwestward, in which direction it extends at least to Redwood Falls, *Miss Butler*, and Emmet county, Iowa (rare), *Cratty*.

LEMNACEÆ. Duckweed Family.

LEMNA, L. Duckweed. Duck's-meat.

L. trisulca, L. Duckweed. Duck's-meat.

Throughout the state. Minnesota river, *Parry;* Blue Earth county (flowering plentifully in 1882), *Leiberg;* frequent in Martin county, and in Emmet county, Iowa, *Cratty;* Minneapolis, *Arthur*, *Roberts*; Taylor's Falls, *Mrs. Ray;* Pembina, *Chickering;* Red river prairie and lake of the Woods, *Dawson*.

L. minor, L. Duckweed. Duck's-meat.

Throughout the state. Blue Earth county, *Leiberg;* Minneapolis, *Arthur*, *Simmons:* Duluth harbor (plentiful), *Roberts;* also, Red river prairie and lake of the Woods (common), *Dawson*.

SPEIRODELA, Schleid. Duckweed. Duck's-meat.

S. polyrrhiza, Schleid. (Lemna polyrrhiza, L.) Duckweed. Duck's-meat.

Throughout the state. Blue Earth county, *Leiberg;* frequent in Martin county, and in Emmet county, Iowa, *Cratty;* Minneapolis (abundant), *Arthur*, *Upham;* Saint Paul, *Kelley;* and northwest to the Saskatchewan river.

WOLFFIA, Hörkel, Schleid. Wolffia.

W. Columbiana, Karsten. Wolffia.

Found by *Mr. Leiberg* in a pond at the southwest edge of the village of South Bend, Blue Earth county; plentiful, covering the surface to a depth of one or two inches in the summer; often blown upon the shore in small ridges by storms; slightly spreading to adjacent ponds; determined by *Dr. Engelmann*, who thinks that it is not a native of these northern latitudes, but has been probably brought by water-fowls. It appears to have become thoroughly acclimated in this locality.

TYPHACEÆ. Cat-tail Family.

TYPHA, Tourn. Cat-tail Flag.

T. latifolia, L. Common Cat-tail. Reed-mace.

Common throughout the state.

SPARGANIUM, Tourn. Bur-reed.

S. eurycarpum, Engelm. Bur-reed.

Throughout the state. Lake of the Woods, *Dawson;* Minneapolis (common), *Roberts;* West Saint Paul, *Miss Butler;* Wabasha, *Gibson;* Blue Earth county, *Leiberg*; Redwood Falls, *Pemberton;* Emmet county, Iowa (rare), *Cratty*.

S. simplex, Hudson. Bur-reed.

Red river valley, at Pembina, *Chickering;* Agate bay, lake Superior, *Juni;* West Saint Paul, *Miss Butler*; lake Pepin, *Miss Manning*.

S. simplex, Hudson, var. **Nuttallii**, Gray. Bur-reed.
St. Croix river, *Parry*.

S. simplex, Hudson, var. **androcladum**, Gray. Bur-reed.
Freeborn county, *Upham*.

S. simplex, Hudson, var. **angustifolium**, Gray. Bur-reed.
Lapham. North. [Isle Royale, *Whitney*.]

S. minimum, Bauhin. Bur-reed.
Brooks, St. Croix river, *Parry*; lake of the Woods, *Dawson*. [North of lake Superior, *Agassiz*; Isle Royale, *Whitney*.] North.

NAIADACEÆ. PONDWEED FAMILY.

NAIAS, L. NAIAD.

N. flexilis, Rostk. & Schmidt. Naiad.
Throughout the state. Blue Earth county, *Leiberg*; plentiful in Martin county and in Emmet county, Iowa, *Cratty*; Minneapolis (abundant), *Miss Butler*. [Manitoba, *Macoun*.]

ZANNICHELLIA, Micheli. HORNED PONDWEED.

Z. palustris, L. Horned Pondweed.
Peat-bogs between Kasota and Mankato, *Leiberg*. Rare.

POTAMOGETON, Tourn. PONDWEED. POTAMOGETON.

P. natans, L. Pondweed.
Common, or frequent, throughout the state.

P. Claytonii, Tuckerman. Pondweed.
Plentiful near Stewart river, north of lake Superior, *Roberts*.

[P. rufescens, Schrader, will probably be found in northeastern Minnesota.]

P. lonchites, Tuckerm. Pondweed.
Le Sueur river, Blue Earth county, *Leiberg*; Emmet county, Iowa (frequent), *Cratty*. South.

P. amplifolius, Tuckerman. Pondweed.
Plentiful in Devil's Track lake, north of lake Superior, *Roberts*; lake Pepin, *Miss Manning*; Emmet county, Iowa (rare), *Cratty*.

P. gramineus, L., var. **heterophyllus**, Fries. Pondweed.
Throughout the state. Abundant in Devil's Track lake, *Roberts*; frequent in Emmet county, Iowa, *Cratty*.

P. lucens, L. Pondweed.
Throughout the state, but infrequent. Lake Minnetonka, *Roberts*; White Bear lake, Ramsey county, *Simmons*; Stearns county, *Campbell*. [North of lake Superior, *Agassiz*; Manitoba, *Macoun*.]

P. lucens, L., var. **minor**, Nolte. Pondweed.
Lake Minnetonka, *Herrick*, *Roberts*.

[P. prælongus, Wulfen., will doubtless be found in Minnesota.]

P. Illinoensis, Morong.* Pondweed.

Emmet county, Iowa, *Cratty, Arthur;* doubtless also to be found in southern Minnesota.

P. perfoliatus, L. Pondweed.

Throughout the state. Blue Earth county, *Leiberg;* lake Calhoun, Minneapolis, *Upham*; Stearns county, *Campbell;* lake of the Woods, *Dawson.*

P. perfoliatus, L., var. **lanceolatus,** Robbins. Pondweed.

Also throughout the state. Lake Minnetonka, *Arthur;* frequent in Martin county, and in Emmet county, Iowa, *Cratty.*

P. zosteræfolius, Schum. (P. compressus, Fries, not L.) Pondweed.

Minneapolis, *Simmons;* Blue Earth county, *Leiberg*, and Martin county (frequent), *Cratty*, both determined by *Rev. T. Morong.*

P. pauciflorus, Pursh. Pondweed.

Minneapolis (common), *Miss Butler;* lake Pepin, *Miss Manning;* Blue Earth county, *Leiberg*, determined by *Rev. T. Morong;* Emmet county, Iowa (frequent), *Cratty.* [North of lake Superior, *Agassiz.*]

P. pusillus, L. Pondweed.

Throughout the state. Lake of the Woods, *Dawson;* White Bear lake, Ramsey county, *Simmons;* Emmet county, Iowa, *Cratty*, determined by *Rev. T. Morong.*

P. pusillus, L., var. **major,** Fries. Pondweed.

Martin county (frequent), *Cratty*, determined by *Rev. T. Morong.*

P. pusillus, L., var. **vulgaris,** Fries. Pondweed.

Lake Minnetonka (plentiful), *Herrick, Roberts;* Winona lake, *Holzinger.*

P. pectinatus, L. Pondweed.

Throughout the state. Mississippi river near Saint Cloud, *Campbell;* Blue Earth county, *Leiberg;* Martin county (abundant), *Cratty*, determined by *Rev. T. Morong.* [North of lake Superior, *Agassiz;* James river, Dakota, *Geyer.*]

ALISMACEÆ. WATER-PLANTAIN FAMILY.

TRIGLOCHIN, L. ARROW-GRASS. (This genus and SCHEUCHZERIA are included in the preceding order, NAIADACEÆ, by *Watson* in the *Botany of California.*)

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*POTAMOGETON ILLINOENSIS, Morong. Stem stout, branching towards the summit; floating leaves opposite, thick, coriaceous, oval or ovate, 2 to 3 inches long by 1½ broad, 19- to 23-nerved, rounded or sub-cordate at base, and with a short blunt point at the apex, on short petioles; submersed leaves comparatively few, dark green, oblong-elliptical, acute at each end, usually ample (the largest nearly 8 inches long and 1½ wide), entire, rarely mucronate, nearly or quite sessile, the uppermost opposite; stipules coarse, free, obtuse, strongly bicarinate, about 2 inches in length; peduncles often clustered at the summit of the stem, 2 to 4 inches long, usually somewhat thickening upwards; spikes about 2 inches long, densely flowered; fruit roundish obovate, 1¾ to 2 lines long and 1 to 1½ lines wide, 3-keeled on the back, the middle keel prominent and sometimes shouldered at the top, flattened and slightly impressed on the sides, obtuse or occasionally pointed at the base, the style short and nearly facial, the apex of the embryo pointing transversely inwards. Allied to P. lucens, L., in habit, but with larger fruit, and in foliage quite distinct. *Morong* in *Botanical Gazette*, vol. v, p. 50 (May, 1880).

T. palustre, L. Arrow-grass.

Throughout the state. Peat-bogs between Kasota and Mankato (plentiful), *Leiberg;* Red river valley, *Scott.*

T. maritimum, L. Arrow-grass.

Lapham. Stearns county, *Campbell.* [Sheyenne river and Devil's lake, Dakota, *Geyer.*] North.

T. maritimum, L., var. **elatum,** Gray. Arrow-grass.

Duluth (common), and Minneapolis (frequent), *Roberts;* Chisago county, *Upham;* upper Minnesota river, *Parry;* also, peat-bogs between Kasota and Mankato (plentiful), *Leiberg;* Emmet county, Iowa (rare), *Cratty.*

SCHEUCHZERIA, L. SCHEUCHZERIA.

S. palustris, L. Scheuchzeria.

St. Croix river, *Parry;* near Clearwater, Wright county, *Mrs. Terry;* Minneapolis, *Kassube,* (lake Calhoun) *Miss Butler;* Emmet county, Iowa (rare), *Cratty.*

ALISMA, L WATER-PLANTAIN.

A. Plantago, L. Water-Plantain.

Common throughout the state. "Very variable as respects foliage, the forms being determined chiefly by the place of growth and not deserving to rank as varieties." *Watson, Botany of California.*

ECHINODORUS, Richard, Engelmann. ECHINODORUS.

E. parvulus, Engelm. Echinodorus.

Muddy margins of ponds, St. Croix, *Parry.* [North of lake Superior, *Agassiz.*]

SAGITTARIA, L. ARROW-HEAD.

S. variabilis, Engelm. Common Arrow-head.

Common (especially the var. hastata, Gray) throughout the state; var. angustifolia, Gray, Minneapolis, *Miss Butler.* "This plant, so variable in foliage, and so abundant in distribution, furnishes an important article of native food in the tubers which beset its fibrous roots. These tubers (from the fact of their affording nourishment to the larger aquatic fowls which congregate in such abundance about the northwestern lakes) are called by the Chippewas, Wab-es-i-pin-ig, or swan potatoes, a name which has been naturally appropriated to several streams of this region, Wabesipinicon; meaning, the abode of the swan potato. These tubers frequently attain the size of a small hen's-egg, and are then eaten by the Indians, with whom they are a great favorite. In their raw state they contain a bitter, milky juice, but in boiling become sweet and palatable." *Parry.*

S. heterophylla, Pursh. Arrow-head.

Upper Mississippi river, *Houghton;* Hennepin county, *Roberts, Griswold;* probably extending through the south half of the state.

S. graminea, Michx. Arrow-head.

Minneapolis, *Kassube.* South.

S. cristata, Engelm.* Arrow-head.

Emmet county, Iowa, on the south boundary of Minnesota, *Cratty;* doubtless also in this state.

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*SAGITTARIA CRISTATA, Engelm. Flowers only of the lowest whorl fertile; fruit-heads much larger than in S. graminea; achenia broad, with a conspicuous horizontal

HYDROCHARIDACEÆ. FROG'S-BIT FAMILY.

ANACHARIS, Richard. WATER-WEED.

A. Canadensis, Planchon. Water-weed.

Common throughout the state. Duluth harbor (plentiful), and Minneapolis, *Roberts;* lake Minnetonka, *Miss Butler;* Winona lake, *Holzinger;* Blue Earth county, *Leiberg;* plentiful in Martin county, and in Emmet county, Iowa, *Cratty.* This aquatic plant, common, but nowhere troublesome, in this its native country, having become naturalized in Europe, grows there more rankly, so as to become in many places a serious obstruction to river-navigation. Since 1836, when it first appeared in England and Ireland, it has spread eastward upon the continent along the rivers of Belgium, Holland and Germany, and is now complained of at Riga in western Russia. *Popular Science Monthly*, vol. xix, p. 430 (July, 1881).

VALLISNERIA, Micheli. TAPE-GRASS. EEL-GRASS.

V. spiralis, L. Tape-grass. Eel-grass.

With the preceding, in Duluth harbor (plentiful), and Minneapolis, *Roberts*, (lake Calhoun) *Miss Butler;* Blue Earth county, *Gedge*, (Eagle lake) *Leiberg*; Redwood Falls, *Miss Butler.*

ORCHIDACEÆ. ORCHIS FAMILY.

ORCHIS, L. ORCHIS.

O. spectabilis, L. Showy Orchis.

Duluth (frequent), and Saint Paul (rare), *Miss Cathcart;* Stearns county, *Campbell;* Fergus Falls, *Leonard;* Minneapolis (frequent), *Roberts*; Northfield, *Chaney;* Faribault, *Miss Beane*; Blue Earth county, *Leiberg;* frequent at Hesper, Iowa, *Mrs. Carter.*

O. rotundifolia, Pursh. (Habenaria rotundifolia, Richardson.) Orchis.

Detroit, Becker county, *Gedge.* Rare. North.

HABENARIA, Willd. REIN-ORCHIS.

H. tridentata, Hook. Rein-Orchis.

Lapham. Goodhue county, *Sandberg.* [North of lake Superior, *Agassiz.*] Infrequent.

H. virescens, Spreng. Greenish Orchis.

Lake City, *Miss Manning;* Goodhue county, *Sandberg;* Minneapolis, *Roberts;* Stearns county, *Campbell;* Detroit, Becker county, *Gedge.* Infrequent.

H. viridis, R. Br., var. **bracteata**, Reich. Bracted Green Orchis.

Throughout the state. Carlton's Peak, north of lake Superior, and also near Minneapolis, *Roberts;* eastern border of Red river prairie, *Dawson;* Stearns county, *Campbell;* lake Elmo, Washington county, *Leonard;* Blue Earth county, *Leiberg;* Faribault, *Miss Beane;* Winona county, *Holzinger.* [Hesper, *Mrs. Carter*, and south to Council Bluffs, Iowa, *Geyer.*]

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style, and crested back and sides. . . . Near S. graminea, Michx., and perhaps only a variety of it, although the only other Sagittaria with such crests to the achenia is S. natans, Michx. Further observations are needed to eventually place it correctly. *Letter of Dr. Engelmann*, dated March 15th, 1882, in *Arthur's Contributions to the Flora of Iowa, No. V.*

H. hyperborea, R. Br. Northern Green Orchis.

Throughout the state. Lake Superior, *Whitney;* lake of the Woods, *Dawson:* Detroit, Becker county, *Gedge;* Stearns county, *Campbell;* Minneapolis (common), *Roberts;* Hesper, Iowa (rare), *Mrs. Carter.*

H. dilatata, Gray. Rein-Orchis. Northern White Orchis.

Lake Superior, *Whitney;* Detroit, *Gedge;* Minneapolis (common), *Roberts;* St. Croix, river, *Parry.* North.

(H. rotundifolia, Richardson, is found to belong to the preceding genus, Orchis.)

H. obtusata, Richardson. Rein-Orchis.

Abundant north of lake Superior. *Juni, Roberts.* North.

H. Hookeri, Torr. Small Two-leaved Orchis.

Throughout the state. St. Croix river, *Parry;* Elk River, Sherburne county, *Campbell;* Saint Paul, *Miss Cathcart;* Winona county, *Holzinger;* Hesper, Iowa, *Mrs. Carter.* [Lake Superior, *Whitney;* Manitoba, *Macoun.*]

H. orbiculata, Torr. Large Round-leaved Orchis.

North of lake Superior, *Juni, Roberts;* St. Louis river, *Mrs. Herrick.* Northeast.

H. blephariglottis, Hook., var. **holopetala,** Gray. White Fringed-Orchis.

Minnesota Point, near Duluth, *Miss Cathcart.* Rare.

H. leucophæa, Gray. Western Greenish Fringed-Orchis.

Frequent in the south half of the state, extending north at least to Alexandria, *Mrs. Terry,* and Clay county, in the Red river valley, *Upham.* Sometimes almost pure white. It has spread widely in Martin county during the past six or seven years, being now very common in some parts of the county, *Gedge.*

H. lacera, R. Br. Ragged Fringed-Orchis.

Minneapolis, *Roberts;* Goodhue county, *Sandberg.* South.

H. psycodes, Gray. Purple Fringed-Orchis.

Frequent throughout the state.

GOODYERA, R. Br. RATTLESNAKE-PLANTAIN.

G. repens, R. Br. Rattlesnake-Plantain.

North of lake Superior (common), also at Minneapolis, *Roberts;* St. Croix Falls, *Miss Field.* North.

G. pubescens, R. Br. Rattlesnake-Plantain.

North of lake Superior, *Juni;* Taylor's Falls, *Miss Cathcart, Roberts;* Clearwater, Wright county, *Mrs. Terry;* Cannon River Falls, *Blake, Sandberg.*

G. Menziesii, Lindl. Rattlesnake-Plantain.

Isle Royale, *Dr. A. B. Lyons;* doubtless also in Minnesota north of lake Superior.

SPIRANTHES, Richard. LADIES' TRESSES.

S. latifolia, Torr. Ladies' Tresses.

Lapham. Hills of Zumbro river, *Geyer.* Rare. Southeast.

S. Romanzoffiana, Chamisso. Ladies' Tresses.

North shore of lake Superior, *Juni;* Polk county, *Upham;* Clay county, *Gedge;* Stearns county, *Campbell;* Minneapolis, *Roberts;* Cottonwood county, *Holzinger;* peat-bog between Kasota and Mankato (very scarce), *Leiberg.* North.

S. cernua, Richard. Ladies' Tresses.

Common, or frequent, through the south half of the state, and perhaps northward;

lake Superior, *Whitney*, and lake of the Woods, *Dawson;* var. latifolia, Torr., hills of Zumbro river, *Geyer.*

S. gracilis, Bigelow. Ladies' Tresses.

Throughout the state, but infrequent. Pine barrens, St. Croix river, *Parry;* Stearns county, *Campbell;* Minneapolis, *R. S. Williams*, *Roberts*; lake Pepin, *Miss Manning.* [Decorah, Iowa, *Arthur;* Nebraska, *Aughey*; Manitoba, *Macoun.*]

LISTERA, R. Br. TWAYBLADE.

L. cordata, R. Br. Twayblade.

Between lake Superior and the lake of the Woods, *Macoun;* Isle Royale, *Dr. A. B. Lyons.* North.

L. convallarioides, Nutt. Twayblade.

Also, between lake Superior and the lake of the Woods, *Macoun;* Isle Royale, *Dr. A. B. Lyons.* North.

ARETHUSA, Gronov. ARETHUSA.

A. bulbosa, L. Arethusa.

Chisago county, *Upham;* Ramsey county (near lake Johanna), *Roberts;* Red Wing, *Sandberg.* Rare. North.

POGONIA, Juss. POGONIA.

P. ophioglossoides, Nutt. Pogonia.

St. Croix river, *Parry*; Isanti county, *Upham;* Stearns county, *Campbell;* Saint Paul, *Mrs. Terry, Kelley;* Minneapolis (frequent), *Roberts, Miss Butler.*

[P. pendula, Lindl., and P. verticillata, Nutt., should be looked for in this state.]

CALOPOGON, R. Br. CALOPOGON. GRASS PINK.

C. pulchellus, R. Br. Calopogon. Grass Pink.

Common, or frequent, throughout the state.

CALYPSO, Salisb. CALYPSO.

C. borealis, Salisb. Calypso.

Black Point, north shore of lake Superior, *Roberts;* Duluth, *Miss Cathcart.* Rare. North.

MICROSTYLIS, Nutt. ADDER'S-MOUTH.

M. monophyllos, Lindl. Adder's-Mouth.

Lapham. St. Croix river, *Parry;* Taylor's Falls, *Roberts.* Rare. North.

M. ophioglossoides, Nutt. Adder's-Mouth.

Itasca lake, *Houghton;* Mille Lacs, *Campbell;* St. Croix river, *Parry*; at head of lake Pepin, *Sandberg;* Hesper, Iowa (rare), *Mrs. Carter.* [Manitoba, *Macoun.*]

LIPARIS, Richard. TWAYBLADE.

L. liliifolia, Richard. Twayblade.

Minneapolis (one mile west of city), *Roberts;* near Saint Paul, *Mrs. Terry*; Goodhue county, *Sandberg;* Winona county, *Holzinger;* Hesper, Iowa, *Mrs. Carter.* Rare.

L. Lœselii, Richard. Twayblade.

In tamarack swamps near Minneapolis, *Roberts;* Stearns county, *Campbell.* Rare.

CORALLORHIZA, Haller. CORAL-ROOT.

C. innata, R. Br. Coral-root.

Stearns county, *Campbell;* along the northern boundary of Minnesota, *Macoun.* Throughout the state: rare southward, frequent northward.

C. multiflora, Nutt. Coral-root.

Hesper, Iowa, *Mrs. Carter;* Taylor's Falls, *Roberts*; Stearns county, *Campbell;* Pembina, *Havard;* lake Superior, *Whitney*. Throughout the state, but infrequent.

C. Macræi, Gray. Coral-root.

Lapham. [Mackinaw (abundant), *Whitney.*] Rare in Minnesota.

APLECTRUM, Torrey. PUTTY-ROOT. ADAM-AND-EVE.

A. hiemale, Torr. Putty-root. Adam and Eve.

St. Croix Falls, *Miss Field;* Saint Paul, *Miss Cathcart;* Hastings, *Mrs. Ray;* Faribault, *Miss Beane;* in woods at the head of Van Brunt slough, Mankato, *Leiberg.* [Manitoba, *Macoun.*] Rare.

CYPRIPEDIUM, L. LADY'S-SLIPPER. MOCCASIN-FLOWER.

C. arietinum, R. Br. Ram's-head Lady's-Slipper.

Clearwater lake, in the northwest part of Wright county, *Mrs. Terry;* Stearns county, *Campbell;* Detroit, Becker county, *Gedge.* Rare. North.

C. candidum, Muhl. Small White Lady's-Slipper.

Through the south half of the state, mostly infrequent and local. Winona county, *Holzinger;* lake Pepin, *Miss Manning;* Cannon River Falls, *Blake, Sandberg;* Minneapolis, *Roberts*, (lake Harriet) *Mrs. Terry;* Anoka county, also New Ulm, *Juni;* Faribault, *Miss Beane;* Nicollet county, *Leiberg;* Emmet county, Iowa (plentiful), *Cratty*; extending north at least to Morrison county, *Miss Babbitt*, the upper Mississippi river, *Garrison*, and Fergus Falls, *Leonard*.

C. parviflorum, Salisb. Smaller Yellow Lady's-Slipper.

Frequent throughout the state, excepting far southward.

C. pubescens, Willd. Larger Yellow Lady's-Slipper.

Common, or frequent, throughout the state.

C. spectabile, Swartz. Showy Lady's-Slipper.

Common, or frequent, often growing on dryish hard land, throughout the state; excepting perhaps far northeastward, in which direction it extends at least to the St. Louis river, *Mrs. Herrick*, the upper Mississippi river, *Garrison*, Detroit, Becker county (abundant), *Gedge*, and Pembina, *Havard*.

C. acaule, Ait. Stemless Lady's-Slipper.

Frequent through the north half of the state; extending south to Saint Paul, *Miss Cathcart*, Minneapolis (in tamarack swamps) *Roberts*, and Martin county, *Gedge*.

AMARYLLIDACEÆ. AMARYLLIS FAMILY.

HYPOXYS, L. STAR-GRASS.

H. erecta, L. Star-grass.

Common through the south half of the state and in the Red river valley; extending northeast to the upper Mississippi river.

HÆMODORACEÆ. BLOODWORT FAMILY.

ALETRIS, L. COLIC-ROOT. STAR-GRASS.

A. farinosa, L. Colic-root. Star-grass.
Lapham. Rare. Southeast.

IRIDACEÆ. IRIS FAMILY.

IRIS, Tourn. FLOWER-DE-LUCE. IRIS.

I. versicolor, L. Larger Blue Flag.
Common, or frequent, throughout the state.

SISYRINCHIUM, L. BLUE-EYED GRASS.

S. angustifolium, Miller. (S. Bermudiana, L., in part; see *American Naturalist*, vol. xviii, pp. 623-5; June, 1884.) Blue-eyed Grass.

This variable species (in the varieties anceps and mucronatum, with intermediate forms) is found throughout the state, being usually abundant in all the prairie region. The var. albidum occurs infrequently at Marine, Washington county, *Miss Field*, Minneapolis, *Roberts*, *Kassube*, and southwestward.

DIOSCOREACEÆ. YAM FAMILY.

DIOSCOREA, Plumier. YAM.

D. villosa, L. Wild Yam-root.

Common, or frequent, through the south part of the state; extending north to Saint Paul, *Roberts*, Minneapolis, *Kassube*, (lake Calhoun) *W. H. Hatch*, Anoka county, *Juni*, and the north side of Snake river east of Chengwatana, Pine county, *Upham*.

SMILACEÆ. SMILAX FAMILY.

SMILAX, Tourn. GREENBRIER. CATBRIER.

S. rotundifolia, L. Common Greenbrier.

Lake Superior to the Mississippi, *Houghton;* Stearns county, *Mrs. Blaisdell;* Anoka county, *Juni;* Minneapolis (common), *Roberts*, *Upham;* Minnesota river, *Parry;* Faribault, *Miss Beane;* Goodhue county, *Sandberg;* lake Pepin, *Miss Manning;* Houston county, *Winchell*.

S. hispida, Muhl. Greenbrier. Catbrier.

Minnesota river, *Parry;* Blue Earth county, *Leiberg;* frequent in Martin county, and in Emmet county, Iowa, *Cratty;* Kanabec county, *Upham*.

S. herbacea, L. Carrion-Flower.

Common, or frequent, throughout the state.

S. herbacea, L., var. **pulverulenta**, Gray. Carrion-Flower.

Vicinity of Hesper, Iowa, on the southern border of Houston and Fillmore counties, *Mrs. Carter;* Lake City, *Mrs. Ray;* Faribault, *Miss Beane*.

LILIACEÆ. Lily Family.

TRILLIUM, L. Trillium. Three-leaved Nightshade. Wake-Robin.

T. sessile, L. Trillium. Three-leaved Nightshade. Wake-Robin.
Saint Paul, *Miss Cathcart.* Southeast.

T. recurvatum, Beck. Trillium. Thre-leaved Nightshade.
Lake Pepin, *Miss Manning.* Southeast.

T. grandiflorum, Salisb. Large White Trillium or Wake-Robin.
Frequent northward; extending southeast to lake Pepin, *Miss Manning*, Northfield, Rice county, *Chaney*, and Blue Earth county, *Gedge*.

T. erectum, L. Purple Trillium or Birthroot. Bath Flower.
Lapham. Blue Earth county, *Leiberg;* Saint Paul, *Miss Cathcart;* Minneapolis, *Simmons.* Rare. (Watson's *Revision of the North American Liliaceæ* makes this name include also the two following, which, however, are retained here as in Gray's *Manual.*)

T. erectum, L., var. **album**, Pursh. Trillium. Birthroot.
Winona, *Holzinger;* Marine, Washington county, *Miss Field;* Stearns county, *Garrison.* Rare.

T. erectum, L., var. **declinatum**, Gray. Trillium. Birthroot.
Frequent, in some localities plentiful, throughout the state.

T. cernuum, L. Nodding Trillium or Wake-Robin.
Common, or frequent, throughout most of the state; extending north at least to Grand Marais, *Roberts*, and the upper Mississippi river, *Garrison;* and west to Fergus Falls, *Leonard*, and Redwood Falls, *Pemberton*.

T. nivale, Riddell. Dwarf White Trillium. Snowy Trillium.
Winona, *Holzinger;* lake Pepin, *Miss Manning;* near South Bend, Blue Earth county, *Leiberg;* Emmet county, Iowa, *Cratty.* Rare. South.

MEDEOLA, Gronov. Indian Cucumber-root.

M. Virginiana, L. Indian Cucumber-root.
Lapham. Near Saint Paul, *Mrs. Terry;* Lake City, *Mrs. Ray.* Infrequent. Southeast.

MELANTHIUM, L. Melanthium.

M. Virginicum, L. Bunch-flower.
Minneapolis (near lake Calhoun), *Mrs. Terry.* Rare. Southeast.

ZYGADENUS, Michx. Zygadene.

Z. elegans, Pursh. (Z. glaucus, Nutt.) Zygadene. "Alkali-Grass."
Common, often abundant, throughout the west part of the state; frequent eastward to the upper Mississippi river, Sauk Center, and Nicollet and Steele counties; rare farther east in Benton county, at Minneapolis, Castle Rock, Dakota county, Cannon River Falls, Goodhue county, and lake Pepin.

VERATRUM, Tourn. False Hellebore.

V. viride, Ait. American White Hellebore. Indian Poke.
Stearns county, *Garrison.* Infrequent. North.

TOFIELDIA, Hudson. False Asphodel.

T. palustris, Hudson. False Asphodel.

Isle Royale and Thunder bay; doubtless also on the north shore of lake Superior in Minnesota.

T. glutinosa, Willd. False Asphodel.

Stillwater, *Parry*; Minneapolis, *Roberts*, *Miss Butler;* Fergus Falls, *Leonard;* common in the Red river valley, *Upham.*

UVULARIA, L. Bellwort.

U. grandiflora, Smith. Large-flowered Bellwort.

Common, or frequent, through the south half of the state and in the Red river valley,

U. perfoliata, L. Mealy Bellwort.

Frequent in the south half of the state; extending north at least to St. Croix Falls, *Miss Field*, Stearns county, *Campbell*, and the Sisseton Agency, Dakota, *Upham.*

OAKESIA, Watson. Bellwort. Oakesia.

O. sessilifolia, Watson. (Uvularia sessilifolia, L.) Sessile-leaved Bellwort.

Throughout the state. Morrison county, *Miss Babbitt;* Stearns county, *Campbell;* Fergus Falls, *Leonard;* Anoka county, etc., *Upham*; Minneapolis, *Twining*, *Roberts;* Saint Paul, *Miss Cathcart;* Northfield, Rice county, *Chaney.* [Manitoba, *Macoun;* Nebraska, *Aughey.*]

STREPTOPUS, Michx. Twisted-Stalk.

S. amplexifolius, DC. Twisted-Stalk.

North of lake Superior, *Juni;* Taylor's Falls, *Miss Cathcart;* bluffs near (south of) Saint Paul, *Mrs. Terry.* Rare. North.

S. roseus, Michx. Twisted-Stalk.

Common north of lake Superior, *Roberts;* Benton county, *Upham*; bluffs south of Saint Paul, *Mrs. Terry.* North.

CLINTONIA, Raf. Clintonia.

C. borealis, Raf. Northern Clintonia.

Abundant northeastward; extending west to the Winnipeg valley, *Watson*, the sources of the Mississippi, *Houghton*, and Wadena county. *Upham;* and south to Kanabec county (common), Stearns county, *Campbell*, Minneapolis (rare), *Roberts*, Saint Paul, *Miss Cathcart*, and the Wisconsin side of lake Pepin, *Mrs. Ray.*

SMILACINA, Desf. False Solomon's Seal.

S. racemosa, Desf. False Spikenard. False Solomon's Seal.

Common, or frequent, throughout the state.

S. stellata, Desf. False Solomon's Seal.

Also common, or frequent, throughout the state.

S. trifolia, Desf. Three-leaved False Solomon's Seal.

Frequent through the north half of the state; extending south at least to Minneapolis, *Roberts*, and Fergus Falls, *Leonard.*

MAIANTHEMUM, Weber. False Solomon's Seal.

M. Canadense, Desf. (Smilacina bifolia, Ker., var. Canadensis, Gray.) Two-leaved False Solomon's Seal.

Common throughout the state.

P. biflorum, Ell. Smaller Solomon's Seal.

Frequent, occasionally common, throughout most of the state, extending north to Lake Superior, *Whitney*, and Pembina, *Havard*.

P. giganteum, Dietrich. Great Solomon's Seal.

Frequent or common throughout the state. Mr. *Lewis Foote* remarks that these species are not separable in their varying forms, but seem to constitute a single polymorphous species.

ASPARAGUS, L. ASPARAGUS.

A. officinalis, L. *Garden Asparagus.*

Adventive: Minneapolis; Cannon River Falls; Lake Pepin; Blue Earth county; New Ulm.

LILIUM, L. LILY.

L. Philadelphicum, L. Wild Orange-red Lily.

Generally common or frequent throughout the state; especially in Sherburne and Todd counties, in the Red river valley, and thence south to Iowa.

L. Canadense, L. Nodding Wild Yellow Lily.

Common through the east half of the state; less frequent in the Red river valley; rare southwestward.

L. superbum, L. Turk's-cap Lily. "Wild Tiger-Lily."

Upper Mississippi river, *Garrison*; Minneapolis, *Twining*, *Simmons*; Excelsior, Hennepin county, *Mrs. Terry*; Nicollet county, *Aiton*; Martin county, *Gedge*; Cannon River Falls, *Hare*, *Sheldon*; Lake Pepin, *Miss Manning*; Hesper, Iowa, *Mrs. Carter*. Infrequent. South.

ERYTHRONIUM, L. ADDER'S-TONGUE. DOG'S-TOOTH VIOLET.

E. Americanum, Smith. Yellow Adder's-tongue or Dog's-tooth Violet.

Saint Paul, *Miss Cathcart*; Lake City, *Mrs. Ray*; Winona, *Holzinger*; plentiful locally near Hesper, Iowa, *Mrs. Carter*; Blue Earth county, *Leiberg*. Lake Superior, *Whitney*; Nebraska, *Aughey*. Infrequent. East and south.

E. albidum, Nutt. White Adder's-tongue or Dog's-tooth Violet.

Common, often abundant, southeastward; less frequent, or rare, southwestward; extending north to St. Croix Falls, *Miss Field*, Stearns county, *Campbell*, and Brown county, *Juni*.

E. propullans, Gray.* Adder's-tongue. Dog's-tooth Violet.

Faribault, abundant, *Miss Beane*; described and figured by *Professor Gray* in the *American Naturalist*, vol. v, pp. 298-300, July, 1871, from specimens "collected at Faribault, Minnesota, by *Mrs. Mary B. Hedges*, the teacher of botany in St. Mary's Hall."

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*ERYTHRONIUM PROPULLANS, Gray. The flower is much smaller than that of any other known species, being barely half an inch long; and its color, a bright pink or rose, like that of the European E. Dens-Canis, reflects the meaning of the generic name (viz., red), which is lost to us in our two familiar Adder-tongues, one with yellow, the other with white, blossoms. The most singular peculiarity of the new species is found in the way in which the bulb propagates. In E. Dens-Canis new bulbs are produced directly from the side of the old one, on which they are sessile, so that the plant as it multiplies forms close clumps. In our E. Americanum long and slender offshoots, or subterranean runners, proceed from the base of the parent bulb and develop the new bulb at their distant apex. Our western E. albidum does not differ in this respect. In the new species an offshoot springs from the ascending slender stem, or sub-

CAMASSIA, Lindl. QUAMASH.

C. Fraseri, Torr. (Scilla Fraseri, Gray.) Eastern Quamash. Wild Hyacinth.

Blue Earth county, *Leiberg;* Martin county, *Cratty.* South.

ALLIUM, L. ONION. GARLIC.

A. tricoccum, Ait. Wild Leek.

Throughout the state, excepting perhaps far northward; but mostly infrequent or rare. Minnesota and St. Croix rivers, *Parry* ; upper Mississippi river, *Garrison*; Fergus Falls, *Leonard* ; Minneapolis, *W. H. Hatch, Roberts;* Goodhue county, *Sandberg;* Blue Earth county, *Leiberg;* New Ulm, *Juni;* Martin and Nobles counties, *Gedge.* [Emmet county, Iowa (very rare), *Cratty* ; lake Superior, *Whitney*]

A. cernuum, Roth. Wild Onion.

Common throughout the prairie portion of the state ; also found at the lake of the Woods, *Dawson.* (The umbel is reflexed until flowering, but then usually becomes erect.)

A. stellatum, Fras. Wild Onion.

Upper Minnesota river, *Geyer;* Tracy, Lyon county, *Gedge;* Minneapolis, *Griswold;* lake Pepin, *Miss Manning*; Stearns county, *Garrison;* Alexandria, *Mrs. Terry.* Rare.

A. reticulatum, Fras.* Wild Onion.

Red river valley, *Scott*, determined by *Mr. Sereno Watson.* West.

A. Schœnoprasum, L. Chives.

Northeastward. *Clark;* Stearns county, *Mrs. Blaisdell;* upper Mississippi river, *Garrison.* [Manitoba, *Macoun.*] North.

A. Canadense, Kalm. Wild Garlic.

Common or frequent, through the south part of the state : extending west to Worthington, *Foote*, and Pipestone county, *Mrs. Bennett*, and north to Minneapolis and Big Stone lake, *Upham.*

JUNCACEÆ. RUSH FAMILY.

LUZULA, DC. WOOD-RUSH.

L. pilosa, Willd. Wood-Rush.

Lake Pepin, *Miss Manning.* [Manitoba, *Macoun.*] Probably common northward.

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terranean sheathed portion of the scape (which is commonly five or six inches long), remote from the parent bulb, usually about mid-way between it and the bases or apparent insertion of the pair of leaves : this lateral offshoot grows downward, sometimes lengthening as in the foregoing species, sometimes remaining short, and its apex dilates into the new bulb. . . . Scape bulbiferous from its sheathed portion below the developed leaves ; these oblong-lanceolate, acuminate, slightly mottled ; perianth rose-purple or pink (half an inch long) ; the segments acute, all with a yellow spot but plane at the base, the inner like the outer destitute of either groove or tooth-like appendages, but a little more narrowed at base ; anthers merely oblong ; style hardly at all narrowed downward, entire, the small stigma even barely three-lobed; ovules few (4 to 6) in each cell. *Gray* in *American Naturalist*, vol. v.

*ALLIUM RETICULATUM, Fras. Coats densely fibrous ; scape 3 to 8 inches high, subterete ; leaves very narrowly linear, elongated ; spathe usually 2-valved ; umbel many-flowered, spreading : pedicels usually short (2 to 6 lines long) ; stamens and style shorter than the usually acute (3 to 4 lines long) white or slightly pinkish sepals ; crest mostly short. *Watson's Revision of Allium* in *King's Expl. of the Fortieth Parallel*, and his *Revision of the North American Liliaceæ*, *Proc. Amer. Acad.*, xiv.

L. spadicea, DC., var. **melanocarpa**, Meyer. (L. parviflora, Desv., var. melanocarpa, Gray.) Wood-Rush.

Frequent along the northern boundary of Minnesota, *Macoun*.

L. campestris, DC. Wood-Rush.

Throughout the state. Upper Mississippi river, *Garrison*; Anoka county, etc. *Upham*; lake Pepin, *Miss Manning*; Emmet county, Iowa (very rare), *Cratty*.

JUNCUS, L. Rush. Bog-Rush.

J. effusus, L. Common or Soft Rush.

Throughout the state. *Lapham*. Lake Pepin, *Miss Manning*. [North of lake Superior, *Agassiz*; Manitoba, *Macoun*.]

J. filiformis, L. Bog-Rush.

Lapham. Lake Pepin, *Miss Manning*. [Manitoba, *Macoun*; Nebraska, *Aughey*.] Throughout the state, chiefly northward.

J. Balticus, Dethard. Bog-Rush.

Lapham. Pembina, *Chickering*; Red river country generally, *Dawson*. [North of lake Superior, *Agassiz*; Emmet county, Iowa (rare), *Cratty*.] Throughout the state, chiefly northward.

J. Balticus, Dethard, var. **montanus**, Engelm.* Bog-Rush.

Lake of the Woods, *Dawson*, *Macoun*. West.

J. bufonius, L. Bog-Rush.

Lake Pepin, *Miss Manning*; lake of the Woods, *Macoun*. [James river, Dakota, *Geyer*.] Infrequent.

[J. stygius, L., and J. Gerardi, Loisel, should be looked for in Minnesota north of lake Superior.]

J. tenuis, Willd. Bog-Rush.

Common, or abundant, throughout the state.

J. tenuis, Willd., var **congestus**, Engelm. Bog-Rush.

Blue Earth county, *Leiberg*, determined by *Watson*. Southwest. [Branches contracted into a head, and flowers darker-colored. *Engelmann*, *Trans. Acad. Sci., Saint Louis*, vol. ii.]

J. Vaseyi, Engelm. Vasey's Bog-Rush.

Steele county, *Upham*; lake Superior and Manitoba, *Macoun*; probably occurring throughout Minnesota.

J. pelocarpus, E. Meyer. Bog-Rush.

Lapham. St. Croix river, *Parry*; lake Pepin. *Miss Manning*.

J. alpinus, Villars, var. **insignis**, Fries. Bog-Rush.

North shore of lake Superior, *Juni*; lake of the Woods, *Dawson*, *Macoun*. North.

J. acuminatus, Michx., var. **legitimus**, Engelm. Bog-Rush.

Lapham. [North of lake Superior, *Agassiz*; Manitoba, *Macoun*; Devil's lake, Dakota, *Geyer*.] Throughout the state.

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*JUNCUS BALTICUS, Dethard, var. MONTANUS, Engelmann. Sepals nearly of the same length, the minor ones sometimes more obtuse; anthers four times longer than the filament; capsule ovate-pyramidal, angled, beaked; seeds smaller, narrower and longer pointed than in the eastern form. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*]

J. nodosus, L. Bog-Rush.

Common throughout the state.

J. nodosus, L., var. **megacephalus**, Torr. Bog-Rush.

Common in Martin county, and in Emmet county, Iowa, *Cratty*; Manitoba, *Macoun*; probably throughout the state.

J. Canadensis, J. Gay, var. **longicaudatus**, Engelm. Bog-Rush.

Minneapolis. *Simmons*; Blue Earth county, *Leiberg*. Through the south part of the state.

J. Canadensis, J. Gay, var. **coarctatus**, Engelm. Bog-Rush.

North of lake Superior, *Juni*. [Manitoba, *Macoun*.] North.

PONTEDERIACEÆ. PICKEREL-WEED FAMILY.

PONTEDERIA, L. PICKEREL-WEED.

P. cordata, L. Pickerel-Weed.

Lake Pepin, *Miss Manning*; White Bear lake, Ramsey county, *Simmons*, *Kelley*; lake Minnetonka, also in Douglas county, *Mrs. Terry*; pond in section 23, Burns, Anoka county, *Roberts*; Stearns county, *Campbell*. Infrequent.

SCHOLLERA, Schreber. WATER STAR-GRASS.

S. graminifolia, Willd. Water Star-grass.

White Bear lake, Ramsey county, *Simmons*; lake Minnetonka, *Roberts*, *Miss Butler*; Blue Earth county, *Leiberg*. South.

COMMELYNACEÆ. SPIDERWORT FAMILY.

TRADESCANTIA, L. SPIDERWORT.

T. Virginica, L. Common Spiderwort.

Common, often abundant, through the south half of the state; extending northeast to the upper Mississippi river, and north to lake Winnipeg, *Watson*. Southwestward the flowers are often seen varying from the ordinary blue to purple and pink.

XYRIDACEÆ. YELLOW-EYED-GRASS FAMILY.

XYRIS, L. YELLOW-EYED GRASS.

X. flexuosa, Muhl. Yellow-eyed Grass.

Sandy lake, about three miles north of East Minneapolis, *Roberts*; also collected near Minneapolis by *Mr. Kassube*; White Bear, Ramsey county, *Miss Field*. Rare.

ERIOCAULONACEÆ. PIPEWORT FAMILY.

ERIOCAULON, L. PIPEWORT.

E. septangulare, With. Pipewort.

Lake Agnes, Alexandria, Douglas county, *Mrs. Terry*. Rare.

CYPERACEÆ. Sedge Family.

CYPERUS, L. Galingale.

C. diandrus, Torr., var. **castaneus**, Torr. (C. rivularis, Kunth.) Galingale.

Common through the south half of the state ; extending north at least to the upper Mississippi river, *Garrison*.

C. erythrorrhizos, Muhl. Galingale.

Lapham. [In Michigan, Wisconsin and Nebraska.] Infrequent. South.

C. aristatus, Rottb. (C. inflexus, Muhl.) Galingale.

St. Croix river, *Parry;* Minneapolis, *Kassube, Simmons;* Blue Earth county, *Leiberg*. [Manitoba, *Macoun*, (lake Winnipeg) *Watson*; Emmet county, Iowa (rare), *Cratty*.] Throughout the state.

C. esculentus, L. (C. phymatodes, Muhl.) Galingale. Nut-Grass.

Lapham. Blue Earth county, *Leiberg;* Cannon River Falls, *Blake, Sandberg;* Minneapolis, *Simmons*. South.

C. strigosus, L. Galingale.

Common throughout the state, excepting perhaps northeastward. (Specimens apparently referable to this species, collected by *Mr. Simmons* near lake Calhoun, in Minneapolis, have only 8- to 12-flowered spikes, scarcely a half inch long, arranged in densely crowded spicate clusters, the lower portions of which are sometimes compound.)

C. Michauxianus, Schultes. Galignale.

Lapham. Blue Earth county, *Leiberg*. Probably frequent, or common, through the south part of the state.

C. Schweinitzii, Torr. Galingale.

Throughout the south half of the state and in the Red river valley. Sandy ridges, St. Croix river, *Parry;* Minneapolis (common), *Kassube, Upham;* Blue Earth county, *Leiberg*. [Emmet county, Iowa (very rare) *Cratty;* Devil's lake, Dakota, *Geyer*.]

C. filiculmis, Vahl. Galingale.

Common, or frequent, throughout the state, excepting perhaps northeastward. Upper Mississippi river, *Houghton;* Minnesota river, *Parry;* Minneapolis, *Kassube, Simmons, Upham;* Blue Earth county, *Leiberg*. [Manitoba, *Macoun*.]

DULICHIUM, Richard. Dulichium.

D. spathaceum, Pers. Dulichium.

Common, or frequent, throughout the state.

HEMICARPHA, Nees. Hemicarpha.

H. subsquarrosa, Nees. Hemicarpha.

Lapham. Blue Earth county, *Leiberg;* Minneapolis, plentiful beside railroad near the University, *Arthur*, and near lake Calhoun, *Simmons;* probably frequent through the south half of the state.

ELEOCHARIS, R. Br. Spike-Rush.

E. obtusa, Schultes. Spike-Rush.

Common through the south half of the state and in the Red river valley.

E. palustris, R. Br., var. **glaucescens,** Gray. Spike-Rush.
Minneapolis, *Kassube*.

E. compressa, Sullivant. Spike-Rush.
Blue Earth county, *Leiberg*. [Emmet county, Iowa (rare), *Cratty*.] South.

E. intermedia, Schultes. Spike-Rush.
Lapham. Blue Earth county, *Leiberg*. Probably throughout the state.

E. tenuis, Schultes. Spike-rush.
Lapham. Blue Earth county (frequent in peat-bogs), *Leiberg*. [Devil's lake, Dakota, *Geyer*.]

E. acicularis, R. Br. Spike-Rush.
Common throughout the state.

E. Wolfii,* Gray. Wolf's Spike-Rush.
Collected by *Mr. R. I. Cratty* on wet prairies in Emmet county, Iowa, adjoining the south line of Martin and Jackson counties in Minnesota, where it may also be confidently looked for ; determined by *Mr. William Boott*.

E. pauciflora, Watson. (Scirpus pauciflorus, Lightfoot.) Spike-Rush.
Lake Superior and lake of the Woods, *Macoun*. North.

SCIRPUS, L. BULRUSH or CLUB-RUSH.

S. cæspitosus, L. Bulrush or Club-Rush.
North and northwest of lake Superior, *Macoun*; doubtless in northern Minnesota.

S. pungens, Vahl. Bulrush.
Common throughout the state, excepting perhaps northeastward.

S. Torreyi, Olney. Torrey's Bulrush.
Lapham. Infrequent.

S. lacustris, L. (S. validus, Vahl.) Great Bulrush. "Black Rush." ["Tule" in California (S. lacustris, L., var. occidentalis, Watson).]
Abundant throughout the state. "In common use among the Indians for making mats." *Parry*.

S. debilis, Pursh. Bulrush.
Lapham. [Also in the Wisconsin catalogue, probably on *Dr. Lapham's* authority ; and in Nebraska, *Aughey*.]

[S. maritimus, L., was collected by *Geyer* at Devil's lake and on the Sheyenne and James rivers, in Dakota. It will probably be found in the Red river valley in Minnesota.]

S. fluviatilis, Gray. River Club-Rush.
Through the south half of the state, and in the Red river valley. Minneapolis, *Roberts*; Blue Earth county, *Leiberg*; Emmet county, Iowa (common), *Cratty*; Pembina, *Chickering*.

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*ELEOCHARIS WOLFII, Gray. Rhizomes very small, creeping, perennial, forming small scattered tufts; culm a foot high, slender, pale-glaucescent, striate, two-edged, one side flat, the other convex ; sheath obliquely truncate, hyaline above : spike ovate-oblong, acute ; scales oblong-ovate, obtuse, scarious, pale purple ; style 3-parted ; achenium pyriform, shining, having about 9 nearly equidistant obtuse ribs, with transverse wrinkles between; tubercle small, depressed, truncate, more or less apiculate ; bristles of the perigynium [always?] none.—[First known from Illinois.] The spike, as to form and imbrication of the scales, is much as in E. tenuis and E. acicularis, etc.; but the achenium, with its several longitudinal ribs and delicate transverse lineation, is upon the plan of E. acicularis. This renders the species a very peculiar and distinct one. *Gray, Proc. Amer. Acad.*, vol. x, p. 77, as translated by *Arthur, Contributions to the Flora of Iowa, No. VI.*

rocarpus, Presl.) Bulrush.

reports in Blue Earth county, besides
ustered than usual, forming a compound

apolis, *Simmons.* South.

Wool-Grass.

, excepting perhaps southwestward. Blue Earth
Simmons, Kassube; Todd county, etc., *Upham;* lake of
North of lake Superior, *Agassiz.*]

L. Cotton-Grass.

Alpine Cotton-Grass.

Juni.

Sheathed Cotton-Grass.

state, excepting far southward. Blue Earth county, *Leiberg;* Min-
Anoka county, *Juni;* Chisago county (frequent), *Upham.* [Manitoba,

L., doubtless will be found in this state, but has not yet been re-
in Wisconsin, Nebraska and Manitoba.]

chyum, L. Many-stemmed Cotton-Grass.

or frequent, through the south half of the state, and perhaps farther north.
Juni; Minneapolis, *Herrick, Simmons;* Blue Earth county, *Leiberg;*
Iowa (common), *Cratty.* It has been noted in its var. ANGUSTIFOLIUM,
Minneapolis, *Kassube,* and in Steele county, *Upham.*

stachyum, L., var. **latifolium,** Gray. Cotton-Grass.

apolis, *Upham;* and probably extending, with the var. angustifolium, through
half of the state.

E. gracile, Koch, var. **paucinervium,** Engelm. Graceful Cotton-Grass.

Throughout the state. Chisago county (frequent), and Sherburne county, *Upham;* Minneapolis, *Simmons;* Blue Earth county, *Leiberg.* [Manitoba, *Macoun;* Emmet county, Iowa (rare), *Cratty.*]

FIMBRISTYLIS, Vahl. FIMBRISTYLIS.

F. capillaris, Gray. Fimbristylis.

Lapham. Infrequent. South.

RHYNCHOSPORA, Vahl. BEAK-RUSH.

R. alba, Vahl. Beak-Rush

Lapham. Infrequent. South.

R. capillacea, Torr. Beak-Rush.

Blue Earth county, *Leiberg.* Infrequent. South.

SCLERIA, L. Nut-Rush.

S. triglomerata, Michx. Nut-Rush.
Lapham. Infrequent. South.

S. verticillata, Muhl. Nut-Rush.
Blue Earth county, *Leiberg.* Rare. South.

CAREX, L. Sedge.

C. scirpoidea, Michx. Sedge.
Port Arthur, and "northwest angle" of the lake of the Woods, *Macoun.* North.

C. polytrichoides, Muhl. Sedge.
Little Marais, lake Superior, *Juni.* Probably common throughout the state.

C. Backii, Boott. Back's Sedge.
Minneapolis, *Juni.* North.

C. siccata, Dew. Sedge.
Throughout the state, but infrequent. *Lapham.* Minneapolis, *Kassube;* Emmet county, Iowa (very rare), *Cratty.*

C. disticha, Huds. Sedge.
Throughout the state. Minneapolis, *Juni, Kassube;* Emmet county, Iowa (common) *Cratty.*

C. teretiuscula, Good. Sedge.
Throughout the state. Minneapolis, *Juni;* Blue Earth county, *Leiberg.*

C. teretiuscula, Good., var. **ramosa,** Boott.* Sedge.
Emmet county, Iowa (frequent), *Cratty;* doubtless also in Minnesota.

C. vulpinoidea, Michx. Sedge.
Common throughout the state. Minneapolis, *Juni;* Blue Earth county, *Leiberg*· common in Martin county, and in Emmet county, Iowa, *Cratty.*

C. crus-corvi, Shuttleworth. Sedge.
Blue Earth county, *Leiberg.* South.

C. stipata, Muhl. Sedge.
Common throughout the state. Moose Lake, Carlton county, *Juni;* Blue Earth county, *Leiberg.*

C. conjuncta, Boott. Sedge.
Minneapolis, *Juni, Kassube.* Southeast.

C. Douglasii, Boott.† Douglas's Sedge.
Red river (open prairie); "this is the first Carex to appear in flower, and occurs very abundantly all over the prairie of the Red river," *Dawson, Macoun.* West.

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*CAREX TERETIUSCULA, Good., var. RAMOSA, Boott. (C. prairiea, Dew.) Spike below branched; spikelets ovate, sessile, 5 to 7 on a branch; perigynium ovate-lanceolate, convex both sides, scabrous on the margin, slightly bifid, smaller than the ovate-lanceolate glume; stem 2 to 3 feet high, leafy towards the base. *Wood's Class-Book.*

†CAREX DOUGLASII, Boott. Spike diœcious, with about twelve, sometimes more, ovate spikelets, the upper closely aggregated, the lower occasionally remote and compound; bracts sometimes setaceous, broad at base, sometimes scale-like and mucronate; style exserted; stigmas 2, very long; perigynium elliptic-lanceolate or ovate, tapering to a long serrated bifid beak, shorter than the lanceolate acute scale; achenium orbicular. Root creeping; culm 6 to 12 inches high. *Olney* in *Bot. Rep. of King's Expl. of the Fortieth Parallel.*

C. marcida, Boott.* Sedge.

Red river (open prairie swamp), *Dawson, Macoun*. West.

C. cephaloidea, Boott. Sedge.

Throughout the state, excepting perhaps northeastward. Frequent in Martin county, and in Emmet county, Iowa, *Cratty*; swamps, "northwest angle" of lake of the Woods, *Macoun*.

C. cephalophora, Muhl. Sedge.

Common, or frequent, through the south part of the state. Blue Earth county, *Leiberg*.

C. Muhlenbergii, Schk. Sedge.

Lapham. Chaska, Carver county, *Juni*. Rare. South.

C. rosea, Schk. Sedge.

Common, or frequent, throughout the state. Red river (swamp), *Dawson, Macoun*; Minneapolis, *Juni, Kassube*; Blue Earth county, *Leiberg*; Hesper, Iowa (frequent), *Mrs. Carter*; Martin county, and Emmet county, Iowa (common), *Cratty*.

C. chordorhiza, Ehrh. Sedge.

Throughout the state, but infrequent. [North of lake Superior (at Fort William), *Macoun*; Emmet county, Iowa, *Arthur*.]

C. tenella, Schk. Sedge.

Throughout the state, excepting far southward. Minneapolis, *Juni, Kassube*.

C. trisperma, Dew. Sedge.

Range like the last. Put in bay, lake Superior, *Juni*.

C. tenuiflora, Wahl. Sedge.

Range like the two preceding. Minneapolis, *Juni, Herrick*.

C. canescens, L. Sedge.

Throughout the state: common northward, less frequent southward. Blue Earth county, *Leiberg*.

C. canescens, L., var. **alpicola**, Wahl. (var. vitilis. Carey.) Sedge.

Agate bay, lake Superior, *Juni*. North.

C. arcta, Boott.† Sedge.

Lake Superior, Rainy lake, and lake of the Woods, *Richardson, Boott*. North.

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*CAREX MARCIDA, Boott. Spike oblong, pale, composed of numerous small ovate aggregated androgynous spikelets, staminate at top, the lower spikelets compound; stigmas 2; perigynium tawny, suborbicular, or ovate tapering to a bifid beak, plano-convex, nerved, winged, the upper margins serrated, short-stipitate, nearly equal to the acute ovate scale, which is of a pale straw-color, with a white membranous margin; achenium tawny, lenticular, contracted at base. Culm 1 to 2 feet high, rigid; leaves broad, linear, erect. *Olney* in *Bot. Rep. of King's Expl. of the Fortieth Parallel*.

†CAREX ARCTA, Boott. Spike oblong, capitate, pale, of 8 to 14 spikelets, which are oblong and obtuse, androgynous, at the base sparingly staminate, many-flowered, closely crowded, the lower bracteate; bracts bristle-shaped, dilated at the base, longer than the spikelets; stigmas 2; perigynia ovate, acuminate-beaked, with the minute orifice emarginate and deeply cleft on the outer side, serrate above on the sharp margins, on the outer side slightly nerved, on the inner more sparingly or obsoletely nerved, spreading, pale-green, at length becoming rusty above, membranaceous, at the base thickly spongy; longer than (and as broad as) the scale, which is ovate, acute and mucronulate, whitish or rusty-colored, with a greenish margin and a green mid-nerve. . . . Culm somewhat less than a foot high, sharply triangular, rather stout, upwardly roughish, leaved at the base. Leaves 1 to 1½ lines wide, flat, with a prolonged-tapering tip, longer (often much) than the culm. Bracts at their base broadly dilated, bristle-

C. Deweyana, Schw. Sedge.

Throughout the state. Agate bay, lake Superior, *Juni;* Spirit Lake, Iowa, *Arthur.*

C. echinata, Murr. (C. stellulata, Good.) Sedge.

Throughout the state. North of lake Superior, *Agassiz;* Manitoba, *Macoun;* Emmet county, Iowa, *Cratty, Arthur.*

C. echinata, Murr., var. **microcarpa,** Boeck. (C. stellulata, Good., var. scirpoides, Carey.) Sedge.

Minneapolis, *Juni, Kassube;* Emmet county, Iowa (frequent), *Cratty.*

C. arida, Schw. & Torr. Sedge.

Throughout the state, but infrequent. [Near Winnipeg, Manitoba, *Macoun;* upper Missouri river, *Geyer.*]

C. scoparia, Schk. Sedge.

Common throughout the state. Minneapolis, *Juni;* Blue Earth county, *Leiberg.*

C. lagopodioides, Schk. Sedge.

Common, or frequent, throughout the state. *Lapham.* Savannah river, *Houghton;* Agate bay, lake Superior, *Juni.*

C. cristata, Schw. Sedge.

Throughout the state, excepting perhaps northeastward. Blue Earth county, *Leiberg;* Emmet county, Iowa (rare), *Cratty.*

C. adusta, Boott. Sedge.

Throughout the state, but rare. Red river valley, at Pembina, *Dawson;* Minneapolis, *Kassube.*

C. straminea, Schk. (Including vars. typica, tenera, aperta and festucacea, Boott.) Sedge.

Throughout the state. St. Louis river, *Houghton;* Pembina, *Dawson;* Minneapolis, *Kassube;* Blue Earth County, *Leiberg.*

C. straminea, Schk., var. **Crawei,** Boott. (vars. hyalina and Meadii, Boott.) Sedge.

Common in Emmet county, Iowa (on the southern boundary of Minnesota), *Cratty.*

C. vulgaris, Fries. Sedge.

Throughout the state, excepting perhaps far southward. Minneapolis, *Juni;* Blue Earth county, *Leiberg.*

C. aquatilis, Wahl. Sedge.

Range like the last. *Lapham.* Minneapolis, also New Ulm, *Juni.*

C. stricta, Lam. (See *Botanical Gazette* for Sept., 1884.) Sedge.

Common throughout the state. Agate bay, lake Superior, *Juni;* Red river, *Dawson, Macoun;* Minneapolis, *Kassube;* Blue Earth county, *Leiberg;* plentiful in Emmet county, Iowa, *Cratty.*

C. lenticularis, Michx. Sedge.

Agate bay, lake Superior, *Juni.* . North.

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shaped, the lower 5 or 6 elongated, the lowest hardly equaling the spike. Spike 10 to 16 lines long, 3 to 6 lines broad. Spikelets 5 lines long, 2 to 2¼ lines broad, dense flowered, at the base sparingly staminate but never narrowed below, all crowded. Scales similar. Perigynium 1.3 to 1.4 lines long, 0.6 line broad. Achenium 0.7 line long, 0.5 line broad, suborbicular, prolonged at the base, plano-convex, pale ; the base of the style enlarged.——It differs from C. canescens and C. vitilis in its more numerous spikelets, in their being capitate and the lower ones bracted, and in its longer leaves. In general appearance it more nearly resembles C. elongata, yet in the form and nervation of the perigynium it is far different. *Boott's Illustrations of Carex.*

C. crinita, Lam. Sedge.

Throughout the state, excepting perhaps far southward. North of lake Superior, *Juni.*

C. crinita, Lam., var. **gynandra**, Schw. & Torr. (C. **gynandra**, Schw.) Sedge.

Agate bay, lake Superior, *Juni.* Rare.

C. limosa, L. Sedge.

Throughout the state, but infrequent. [North of lake Superior (at Fort William), *Macoun*: Emmet county, Iowa, *Cratty, Arthur.*]

C. Magellanica, Lam. (C. irrigua, Smith.) Sedge.

Throughout the state, excepting far southward, but rare. Put in bay, lake Superior, *Juni.*

C. Buxbaumii, Wahl. Sedge.

Throughout the state. Blue Earth county, *Leiberg*: Emmet county, Iowa (frequent), *Cratty*

C. atrata, L. Sedge.

Kakabeka falls, north of lake Superior, *Macoun*: probably also in northern Minnesota.

C. alpina, Swartz. Sedge.

Temperance river, lake Superior, *Juni.* North.

C. aurea, Nutt. Sedge.

Throughout the state, excepting perhaps far southward. Lake of the Woods (thicket), *Dawson, Macoun*; Minneapolis, *Juni, Kassube.*

[C. aurea, Nutt., var. androgyna, Olney,[*] collected by *Macoun* at Thunder bay, lake Superior, should be looked for in northern Minnesota.]

C. livida, Willd. Sedge.

Greenwood river, lake Superior, *Juni.* Rare. North.

C. vaginata, Tausch. Sedge.

Certainly in swamps in northern Minnesota, *Macoun.* North.

C. Meadii, Dew. Mead's Sedge.

Minneapolis, *Kassube.* [Manitoba, *Macoun*; Iowa, *Arthur.*]

C. Meadii, Dew., var. **Bebbii**, Arthur.[†] Sedge.

Emmet county, Iowa, *Cratty, Arthur*; doubtless also in Minnesota.

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[*] CAREX AUREA, Nutt., var. ANDROGYNA, Olney. Culms short, more rigid; leaves erect, broader; upper spikes more closely aggregated and denser flowered, the upper spike generally androgynous, having more or less fertile flowers at the top. *Olney* in *Bot. Rep. of King's Expl. of the Fortieth Parallel.*

[†] CAREX MEADII, Dew., var. BEBBII (Olney). This was published in Olney's *Carices Bor.-Amer.*, Fasc. 1, No. 22, without comments, as a variety of C. panicea, L., and has never, I believe, been described. The following description will enable collectors to identify the plant:—Sterile spike with stalk two to four times its length; fertile spikes usually 2, erect, remote, slender-peduncled, rather loosely flowered; sheaths of the foliaceous bracts long and slightly inflated; perigynia and scales as in C. Meadii, except paler, and the former less distinctly nerved; culms slender, somewhat roughish.—Resembles C. tetanica, for which it is sometimes mistaken, in habit and in the loosely flowered fertile spikes, only with longer peduncles, but C. Meadii in the perigynia and scales; it may be merely an attenuated form of the latter. Moist prairies, Illinois, Wisconsin, and northwestwardly. *Arthur* in *Contributions to the Flora of Iowa*, No. VI.

C. Crawei, Dew. Sedge.

Blue Earth county, *Leiberg;* Emmet county, Iowa, *Cratty*, determined by *Mr. William Boott.* [Manitoba, *Macoun.*] Rare.

C. granularis, Muhl. Sedge.

Common throughout the state. Minneapolis, *Juni, Kassube;* Blue Earth county, *Leiberg.*

C. Torreyi, Tuckerman. Sedge.

Minneapolis, *Juni, Kassube;* Red river valley, *Macoun.* North.

C. grisea, Wahl. Sedge.

Blue Earth county, *Leiberg;* Martin county, *Cratty.*

C. Davisii, Schw. & Torr. Sedge.

Through the south part of the state. Minneapolis, *Simmons.*

C. gracillima, Schw. Sedge.

Throughout the state, excepting perhaps far southward. Minneapolis, *Juni, Kassube;* Blue Earth county, *Leiberg.*

C. digitalis, Willd. Sedge.

Minneapolis, *Juni;* north of lake Superior, *Agassiz.* Infrequent.

C. laxiflora, Lam. Sedge.

Common, or frequent, throughout the state. Blue Earth county, *Leiberg.*

C. laxiflora, Lam., var. **blanda**, Boott. Sedge.

Jordan, Scott county, *Juni;* Emmet county, Iowa, *Cratty.* Doubtless other varieties of this species also occur here.

C. eburnea, Boott. Sedge.

Throughout the state, excepting perhaps southwestward. Blue Earth county, *Leiberg;* Emmet county, Iowa (rare), *Cratty.*

C. pedunculata, Muhl. Sedge.

Throughout the state. Rainy lake, *Richardson, Boott;* Blue Earth county, *Leiberg.*

C. Emmonsii, Dew. Emmons' Sedge.

Blue Earth county, *Leiberg.* [Manitoba, *Macoun.*]

C. Pennsylvanica, Lam. Sedge.

Common throughout the state, excepting perhaps northeastward. Minneapolis, *Juni, Kassube;* Blue Earth county, *Leiberg;* Emmet county, Iowa (common), *Cratty.*

C. varia, Muhl. Sedge.

Lapham. Infrequent.

C. Richardsonii, R. Br. Richardson's Sedge.

Throughout the state. Minneapolis, *Juni.* (frequent) *Kassube;* Blue Earth county, *Leiberg.*

C. pubescens, Muhl. Sedge.

Through the south part of the state. Minneapolis, *Juni, Kassube;* Blue Earth county, *Leiberg.*

C. miliacea, Muhl. Sedge.

Range like the last. Minneapolis, *Juni, Kassube.*

C. arctata, Boott. Sedge.

Agate bay, lake Superior, *Juni.* Infrequent.

C. capillaris, L. Sedge.

Port Arthur, lake Superior, *Macoun;* Saskatchewan river, *Bourgeau;* probably also in northern Minnesota.

[illegible]

Throughout the state, excepting perhaps far southward. *Lapham*. Leech lake, *Houghton;* Rainy river and lake, *Richardson*, *Boott*.

C. filiformis, L. Sedge.

Throughout the state. Put in bay, lake Superior, *Juni;* Emmet county, Iowa (frequent), *Cratty*.

C. filiformis, L., var. **latifolia**, Boeck. (C. lanuginosa, Michx.) Sedge.

Throughout the state. North shore of lake Superior (frequent), and Minneapolis, *Juni;* Red river valley near Saint Vincent, *Dawson*, *Macoun;* Emmet county, Iowa (plentiful), *Cratty*.

C. Houghtonii, Torr. Houghton's Sedge.

Itasca lake (Lac la Biche), *Houghton;* Blue Earth county, *Leiberg*. [Manitoba, *Macoun;* Council Bluffs, Iowa, *Geyer*.]

C. riparia, Curtis. Sedge.

Common, or frequent, throughout the state. North of lake Superior (common), *Juni;* lake of the Woods (sandy swamp), *Dawson*, *Macoun;* Blue Earth county, *Leiberg*.

C. aristata, R. Br. Sedge.

Throughout the state, but infrequent. Pembina, *Chickering;* New Ulm, *Juni;* Blue Earth county, *Leiberg*.

C. Pseudo-Cyperus, L., var. **comosa**, W. Boott. (C. comosa, Boott.) Sedge.

Common, or frequent, through the south part of the state. Blue Earth county, *Leiberg:* Emmet and Dickinson counties, Iowa (frequent), *Cratty*, *Arthur*.

C. Pseudo-Cyperus, L. Sedge.

Throughout the state. Lake of the Woods (marsh), *Dawson*, *Macoun;* Chaska, Carver county, *Juni;* Spirit Lake, Iowa, *Arthur*.

C. hystricina, Willd. Sedge.

Common throughout the state, excepting perhaps far northwestward. *Lapham*. Minneapolis, *Juni*, *Kassube;* north of lake Superior, *Agassiz*.

C. tentaculata, Muhl. Sedge.

Range like the last, but less frequent. *Lapham*. Minneapolis, *Simmons;* north of lake Superior, *Agassiz*.

C. intumescens, Rudge. Sedge.

Common throughout the state. Lake of the Woods and Rainy lake, *Richardson*, *Boott;* north of lake Superior (common), also New Ulm, *Juni*.

C. lupulina, Muhl. Sedge.

Blue Earth county, *Leiberg;* Minneapolis, *Simmons*. [Manitoba, *Macoun*.]

C. squarrosa, L. Sedge.

Wabasha, *Gibson*, determined by *Arthur*. South.

C. retrorsa, Schw. Sedge.

Throughout the state. Lake of the Woods, *Richardson*, *Boott;* Moose Lake, Carlton county, *Juni;* Blue Earth county, *Leiberg;* Emmet county, Iowa, *Cratty*.

C. utriculata, Boott. Sedge.

Throughout the state, excepting far southward. Red river prairie, *Dawson*, *Macoun*.

C. monile, Tuckerman. Sedge.

North of lake Superior, *Juni;* Emmet county, Iowa (frequent), *Cratty*.

C. oligosperma, Michx. Sedge.

Agate bay, lake Superior *Juni.* Infrequent. North.

C. saxatilis, L.. var. **miliaris,** Bailey. (C. miliaris, Michx. C. rotundata, Wahl.?, in *Manual.*) Sedge.

Collected in Minnesota by *Dr. J. Leidy;* determined by *S. T. Olney. Bot. Rep. of King's Expl. of the Fortieth Parallel.*

C. longirostris, Torr. Sedge.

Throughout the state. Minneapolis, *Juni, Kassube;* Mankato (common), *Leiberg;* also common in Martin county, and in Emmet county, Iowa, *Cratty.*

[A considerable number of species of Carex not here recorded will doubtless be added by future observers in this state, who should look for all such as approach, or are especially northern, in their geographic range, given in Gray's *Manual.*]

GRAMINEÆ. GRASS FAMILY.

LEERSIA, Swartz. WHITE GRASS. FALSE RICE.

L. Virginica, Willd. White Grass.

Ramsey and Goodhue counties, *Oestlund;* Minneapolis, *Simmons;* Blue Earth county, *Leiberg;* Emmet county, Iowa (rare), *Cratty.* South.

L. oryzoides, Swartz. Rice Cut-grass.

Common in sloughs through the south half of the state and in the Red river valley, *Juni, Upham;* Ramsey and Goodhue counties, *Oestlund;* Blue Earth county. *Leiberg.*

L. lenticularis, Michx. Fly-catch Grass.

Lapham. South.

ZIZANIA, L. WATER or INDIAN RICE.

Z. aquatica, L. Wild Rice. Indian Rice. Water Oats. Folle Avoine (of the French voyageurs).

Common, or frequent, in favorable situations, throughout the state; sometimes attaining, in Brown county, a hight of 13 feet, with leaves 4 feet long, *Juni.*

"Wild rice; *Pshu* of the Sioux; *Manomin* of the Chippewas. This aquatic grass, not uncommon in the Northern United States, acquires in the Northwest an economical importance second to no other spontaneous production. It is the only instance in this region of a native grain, occurring in sufficient quantity to supply the wants of ordinary consumption. It is particularly abundant on the lake-like expansions of rivers, towards their sources, which give such a marked feature to the distribution of these northern streams, and is so grandly illustrated in their main type, the Mississippi. It seems to select, by preference, the lower terminations of these expansions, which generally debouch by a narrowed outlet and considerable fall, constituting rapids. It is in these situations best exposed to the proper degree of inundation, and finds a suitable bed of the slimy sand, in which it grows most readily. It is rarely met with on inland lakes which have no outlet. As an article of food it is highly palatable and nutritious, being generally preferred to the commercial rice. The grain is long, slender, of a brown color. In boiling, it puffs out to a pultaceous mass, and increases its bulk several times. It flowers in August, and is ready for gathering in September, which is conveniently done in canoes, the standing stalks being bent over the sides, and the grain beaten in. Its productive fields, at this season, harbour a great number of wild fowls, which obliges those who wish to secure a full crop. to anticipate the gathering season, by tying up the standing grain into bundles, which gives at the same time a claim to the crop. When gathered it is subjected to a process of parching and thrashing, which. with the imperfect means at the command of the Indians, is the most tedious part of the business." *Parry.*

A. geniculatus, L, var. **aristulatus**, Munro. (**A. aristulatus, Michx.**) Wild Foxtail.

Common, or frequent, throughout the state.

PHLEUM, L. CAT'S-TAIL GRASS.

P. pratense, L. *Timothy. Herd's-Grass* (of New England).

Commonly cultivated, often spontaneous, throughout the state.

SPOROBOLUS, R. Br. (Including VILFA, Beauv.) DROP-SEED GRASS. RUSH-GRASS.

S. asper, Kunth. (Vilfa aspera, Beauv.) Rush-Grass.

Lapham. New Ulm, *Juni.* South.

S. vaginæflorus, Torr. (V. vaginæflora, Torr.) Rush-Grass.

Lapham. Minneapolis (sandy bottomland of the Mississippi river), *Oestlund;* Emmet county, Iowa (frequent), *Cratty.* South.

S. cuspidatus, Torr. (V. cuspidata, Torr.) Rush-Grass.

Lapham. Hennepin and Goodhue counties, *Oestlund;* Emmet county, Iowa (rare), *Cratty.* [Devil's lake, and southern Dakota, *Geyer;* Manitoba, *Macoun.*]

S. depauperatus, Torr.* (V. depauperata, Torr.) Rush-Grass.

Red river valley, at Pembina, *Havard.* West.

S. junceus, Kunth. Drop-seed Grass.

Lapham. New Ulm, *Juni.* Rare. South.

S. heterolepis, Gray. Drop-seed Grass.

Throughout the state, excepting perhaps northeastward. Ramsey county, *Oestlund;* Blue Earth county, *Leiberg;* common in Emmet county, Iowa, *Cratty.* [Eastern Nebraska (abundant), *Aughey;* Manitoba, *Macoun.*]

S. cryptandrus, Gray. Drop-seed Grass.

Through the south part of the state. Ramsey county, *Oestlund;* Minneapolis, *Simmons, Upham, Dr. Vasey;* Emmet county, Iowa (rare), *Cratty;* Spirit lake and Little Sioux river, *Geyer.*

AGROSTIS, L. BENT-GRASS.

A. perennans, Tuckerman. Thin-Grass.

Throughout the state, excepting perhaps northeastward. *Lapham.* Minneapolis, *Upham;* Pembina, *Havard.*

A. scabra, Willd. Hair-Grass.

Common, or frequent, throughout the state.

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*SPOROBOLUS DEPAUPERATUS, Torr. Root perennial, creeping; culms ascending, appressed-branched, slender, often geniculate, glabrous, striate, rather rigid, ½ to 2 feet long; leaves 1 to 3 inches long, narrow and usually convolute, spreading or recurved; panicle very slender and contracted, 1 to 3 inches long; compound or often nearly simple; spikelets small; glumes unequal, ovate, obtuse or acutish, membranous, two-thirds the length of the acute lower palet, which is more less obscurely 3-nerved.—Resembling V. cuspidata, and scarcely differing except in the shorter obtuse glumes of the rather smaller flowers. Lower palet a little more than 1 line long, glabrous or slightly scabrous on the midnerve, the upper one obtuse or erose at the summit. *Watson's Rep.* in *King's Expl. of the Fortieth Parallel.*

A. canina, L. Brown Bent-Grass.

Pipestone county, *Leiberg.* Rare.

A. vulgaris, With. Red-top. Herd's-Grass (of Pennsylvania, &c.)

Probably native northward; also much cultivated, and thence often spontaneous, throughout the state. (According to *Dr. George Thurber*, in the *Botany of California*, this should be called a variety of A. alba, L.)

A. vulgaris, With., var. **alba,** Vasey. (A. alba, L.) Fiorin. White Bent-Grass.

Ramsey county, *Oestlund*; Red Wing, *Sandberg*; Blue Earth county, *Leiberg*; New Ulm, *Juni.* [Lake Superior, *Whitney.*]

CINNA, L. Wood Reed-Grass.

C. arundinacea, L. Wood Reed-Grass.

Throughout the state. *Lapham.* Upper Mississippi river, *Houghton*; Blue Earth county, *Leiberg.*

C. pendula, Trin. (C. arundinacea, L., var. pendula, Gray.) Wood Reed-Grass.

Lake Superior and northward, Gray's *Manual*; doubtless in northern Minnesota.

MUHLENBERGIA, Schreber. Drop-seed Grass.

M. sobolifera, Trin. Drop-seed Grass.

Lapham. South.

M. glomerata, Trin. Drop-seed Grass.

Common, or frequent, throughout the state; not confined to wet places, but often growing on dry and even sandy ground; abundant southwestward, frequently persisting as a plentiful weed in wheat-fields and other cultivated land, *Upham.*

M. glomerata, Trin., var. **ramosa,** Vasey, ined. Drop-seed Grass.

Minneapolis (bluff of Mississippi river near the University), *Upham;* probably the prevailing form of the species in this state. [Much branched from the base upward, the lateral branches slender, naked above, very leafy; outer glumes only slightly longer to one-third longer than the flower; flowering glume sparingly villous. Minnesota, Dakota and Utah. *Letter of Dr. Vasey*, Sept. 30, 1884.]

M. Mexicana, Trin. Drop-seed Grass.

Ramsey county, *Oestlund*; Blue Earth county, and southwestward (common), *Leiberg*; Pembina, *Havard.*

M. sylvatica, Torr. & Gray. Drop-seed Grass.

Lapham. North of lake Superior, *Agassiz.* Probably throughout the state.

M. Willdenovii, Trin. Drop-seed Grass.

Through the south part of the state. *Lapham.* Blue Earth county, *Leiberg*

M. ambigua, Torr.* Drop-seed Grass.

Stony banks of Okaman lake (lake Elysian), Waseca county, *Geyer.*

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*MUHLENBERGIA AMBIGUA, Torr. Panicle dense, spiciform; glumes rather unequal (the inferior one shorter), linear-lanceolate, very acute, 1- or 2-flowered, very hairy at the base; superior valve [palet] with a bristle at the tip equalling it in length, a little shorter than the glumes (exclusive of the awns); superior floret either perfect, and then resembling the inferior, or rudimentary and aristiform. . . . Culms cæspitose, about 1¼ feet high, glabrous; leaves broadly linear; stipules very short, truncate

BRACHYELYTRUM, Beauv. BRACHYELYTRUM.

B. aristatum, Beauv. Brachyelytrum.

Lapham. Blue Earth county. *Leiberg.*

DEYEUXIA, Clarion. (Included in CALAMAGROSTIS, Gray's *Manual.*) REED BENT-GRASS.

D. Canadensis, Beauv. Blue-Joint.

Common throughout the state. The principal grass of the natural meadows bordering streams in the wooded region northward, supplying an abundance of excellent hay for the logging teams of the pineries.

D. stricta, Trin. Reed Bent-Grass.

Throughout the state. Collected in Minnesota by *Nicollet* (*Watson*); Ramsey and Hennepin counties, *Oestlund*; Minneapolis. *Simmons*; Blue Earth County, *Leiberg*; Emmet county, Iowa (common), *Cratty*; Pembina, *Havard*.

D. Lapponica, Kunth. (Calamagrostis Lapponica, Trin., in Addenda of Gray's *Manual.*) Reed Bent-Grass.

Isle Royale, lake Superior. *Prof. T. C. Porter*; doubtless also in northern Minnesota.

D. confinis, Nutt. Reed Bent-Grass.

Lapham. Common in Grant county and the Red River valley, *Upham*.

D. Nuttalliana, Steud. Reed Bent-Grass.

Lapham. Lake Winnibigoshish, *Houghton;* Minneapolis, *Kassube*.

AMMOPHILA, Host. (§§ 2 and 3, CALAMAGROSTIS, Gray's *Manual.*) REED BENT-GRASS.

A. longifolia, Benth. (C. longifolia, Hook.) Reed Bent-Grass.

Throughout the state. Ramsey county, *Oestlund*; Saint Paul, *Kelley;* Minneapolis, also northwestward (common on the beaches of lake Agassiz), *Upham*; Blue Earth county, *Leiberg*.

A. arundinacea, Host. (C. arenaria, Roth.) Sea Sand-Reed.

Common on southern beaches of lake Superior, *Whitney;* doubtless also on the shore of this lake in Minnesota.

ORYZOPSIS, Michx. MOUNTAIN RICE.

O. melanocarpa, Muhl. Mountain Rice.

Lapham. Ramsey county, *Oestlund;* Minneapolis, *Simmons*; Blue Earth county, *Leiberg*.

O. asperifolia, Michx. Mountain Rice.

Throughout the state, excepting perhaps far southward. *Lapham.* Stearns county, *Garrison;* Minneapolis, *Simmons*.

O. Canadensis, Torr. Mountain Rice.

Lapham. Infrequent. Range like the last.

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and lacerate; panicle 4 to 6 inches long, purplish; glumes tapering to a very acute cuspidate point, with a strong green midrib; perianth clothed at the base with whitish hairs, which are nearly half as long as the valves; valves nearly equal; awn a little tortuous, sometimes longer than the valve; superior floret often perfect, and maturing its fruit; when rudimentary, consisting of a mere awn, without any valve. A remarkable species, with the habit of M. glomerata and M. Mexicana. *Torrey* in *Nicollet's Report.*

STIPA, L. FEATHER-GRASS. WEATHER-GRASS.

S. Richardsonii, Link. Richardson's Feather-Grass.

North shore of lake Superior, and in Manitoba, *Macoun;* doubtless reaching into Minnesota. North.

S. spartea, Trin. Porcupine Grass.

Abundant southwestward, being the principal grass of the prairie in some districts, and extending undiminished into Dakota; common north to Clay county and east to New Ulm; frequent northeast to the sources of the Mississippi, *Houghton*, and to Sherburne and Anoka counties, and in the southeast part of the state, *Upham*. (See *American Naturalist*, vol. xviii, pp. 929-931.) The grain is prolonged below in a stout callus or base, needle-like in sharpness, and above in a long twisted awn; both of which are minutely barbed, so that, when inserted in the wool of sheep or in men's clothing, the seed works forward readily but not backward. Thus this very appropriately named grass is a serious annoyance at the time of maturity and falling of the seed, which is in July. Within a few weeks later, these seeds are found to have bored into the hard, dry, clayey soil of the prairie to a depth of two or three inches, having been pushed or impelled in some way by means of the awn. Perhaps this is effected by its lengthening, while braced against the herbage above, after it had been contracted by partially coiling up, these changes being produced by alternations of dryness and moisture, as in days of sunshine and dewy nights; or, as seems more probable, it may be that the wind, blowing upon the awn, first fastens the sharp-pointed grain in the ground, and afterward slowly drills it downward. This was first brought to the notice of the writer by *Mr. T. M. Young*, at the Sisseton Agency, in Dakota, where, late in August, scarcely any seeds of this grass remained on the surface; but they were found very plentifully thus buried in the ground, often only from a half inch to one inch apart. All had penetrated to nearly the same depth, which was about two and a half inches from the surface to the point of the seed, two thirds of this depth being occupied by the lower part of the awn.

ARISTIDA, L. TRIPLE-AWNED GRASS.

A. basiramea, Engelmann.* Triple-awned Grass.

Minneapolis (plentiful in the vicinity of the University, in the sward on dry sandy land with species of Bouteloua, Poa and Andropogon, from which it is noticeably distinguished by its darker purplish color), *Upham;* Saint Cloud (plentiful), *Campbell;* Pipestone City and Luverne, in southwestern Minnesota, and near Rock Rapids, Lyon county, in the northwest corner of Iowa, *Leiberg*.

It has also been collected in Nebraska by *Rev. J. H. Wibbe*, and in Kansas by *Mr. E. Hall;* and *Mr. F. L. Scribner* and *Prof. J. M. Coulter* report it from Iowa and Illinois. *Rev. J. Scott* writes that it occurs at Brandon, Manitoba. [Nebraska specimens show a much greater size (20 inches high) and a more branching habit, the culms becoming geniculate. *Vasey*.]

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*ARISTIDA BASIRAMEA, Engelmann in a letter to W. Upham.——Annual: culms erect, 6 to 15 inches high, slender, much branched at the base (some of the branches very short but floriferous), and with short floriferous branches enclosed in the upper leaf-sheaths: leaves comparatively long (3 to 6 inches), narrowly linear, flat, becoming involute toward the apex, sparsely hairy on the margins below, the upper ones nearly equaling the panicle; sheaths striate, loose; ligule very short, truncate: panicle 1¼ to 3 inches long, erect, rather lax, its base sheathed by the upper leaf; branches of the panicle short, mostly single, the lower in twos or threes; glumes linear, unequal, 1-nerved, lower one 4 lines, upper one 6 lines long including the short bristle-like point: flowering glume nearly terete, spotted with black, about 5 lines long including the short, acute and hairy callus; middle awn about 6 lines long, the lateral ones about 4 lines long, spirally twisted below (when mature). The sheathed flowers are somewhat smaller.

This species was discovered last season by Mr. Warren Upham, at Minneapolis, Minn. The late Dr. Engelmann suggested the name, in a letter, as indicative of its habit, and would have published it if he had lived. It is closely related to A. DICHO-

A. purpurea, Nutt.* Triple-awned Grass.

Blue Earth county, and common westward to Pipestone county, *Leiberg*. South-west.

A. purpurascens, Poir. Triple-awned Grass.

Lapham. St. Croix county, Wisconsin, *Swezey*. Infrequent. South.

A. tuberculosa, Nutt. Triple-awned Grass.

Lapham. Pine barrens, St. Croix river, *Parry*. South.

SPARTINA, Schreber. CORD OR MARSH GRASS.

S. cynosuroides, Willd. Fresh-water Cord-Grass.

Abundant through the south half of the state and in the Red river valley; north of lake Superior, *Agassiz;* making up the greater part of the hay cut in sloughs, worth for fodder fully half as much as the hay of the uplands. Its hight is usually from two to four feet, but occasionally it is eight or nine feet. In the five or six counties next to the southwest corner of the state, because of the scarcity of wood and the high cost of that or coal for fuel, a large proportion of the people burn only hay during the whole year. For this purpose the coarse hay of this species is the only kind used. It is mostly burned in ordinary stoves, having been twisted, then doubled and again twisted, forming wisps about one and a half feet long. The quantity of this fuel required for a year's supply in an ordinary farm-house is from eight to twelve tons.

BOUTELOUA, Lagasca. MUSKIT-GRASS. GRAMA-GRASS.

B. oligostachya, Torr. Muskit-Grass. Grama.

Common, or frequent, southwestward and in the Red river valley; less frequent east to Stillwater and the edge of Wisconsin.

B. hirsuta, Lagasca. Muskit-Grass. Grama.

Common through the south part of the state, extending north to Minneapolis and the St. Croix river, *Parry*; abundant at New Ulm and in Rock and Pipestone counties.

This and the preceding are sometimes called Buffalo Grass in this state, a name which more properly belongs to Buchloe. See pages 14 and 32 of Rothrock's *Report on the Botany of Wheeler's Surveys west of the One Hundredth Meridian* for chemical analyses of Festuca ovina and the two foregoing species of Bouteloua, which with others of this genus are commonly called Grama in the southwestern United States.

B. racemosa, Lagasca. (B. curtipendula, Gray.) Muskit Grass. Grama.

Common through the south part of the state, especially southwestward; likewise in the Red river valley.

TOMA, from which it differs in its shorter, erect (not dichotomous) culms, and in its much larger flowers, and especially in the much longer, spreading, lateral awns. From A. GRACILIS it differs in the shorter panicle, the longer upper leaves with sheathed flowers, and in the flowers being twice as large. From A. RAMOSISSIMA it differs in wanting the larger size, the diffusely branched habit, the much larger flowers with 3- to 5-nerved glumes, and the strong recurved middle awn of that species. *Dr. George Vasey* in the *Botanical Gazette*, vol. ix, p. 76 (May, 1884).

*ARISTIDA PURPUREA, Nutt. Perennial; culms 6 to 15 inches high, simple, erect, slender, mostly glabrous; sheaths narrow, scabrous, exceeding the internodes, pilose at the throat; leaves very narrow, convolute, ½ to 10 inches long; panicle slender, erect or flaccid, 3 to 6 inches long, loosely few-flowered; glumes purplish, the upper 6 to 9 lines long, about twice exceeding the lower, and longer than the flower, bifid and shortly awned; flower densely short-pilose at the pointed base, scabrous above, 6 lines long, the awns equal or nearly so, separate to the base, not jointed, 1 to 2 inches long, cabrous. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*

BUCHLOE, Engelm. BUFFALO GRASS.

B. dactyloides, Engelm.* Buffalo Grass.

Abundant in the vicinity of the pipestone quarry, at Pipestone City, commencing a few rods north of the railroad depot, and extending the whole length of the outcropping ledge of rock northward, in company with a dense growth of prickly pear (Opuntia Missouriensis and O. fragilis); also occurring, at rare intervals, on stony and gravelly soil, in Rock county, and in Lyon county, Iowa; (not found farther east; perhaps in all these places introduced by the Indians in their journeys from the western plains to the pipestone quarry;) *Leiberg*. [Formerly the most abundant species of grass throughout Nebraska, lately disappearing, according to *Aughey*, who attributes its dying out to increased rain-fall.]

GRAPHEPHORUM, Desv. GRAPHEPHORUM.

G. festucaceum, Gray.† Graphephorum.

In Emmet county, Iowa, six miles south of the state line (plentiful upon space of five or six square rods, in edge of lake), *Cratty;* determined by *Prof. Asa Gray;* the first observation of this species in the United States, though it abounds in the Saskatchewan region and extends thence northward, and also is found in northern Europe. Doubtless it occurs in western and northern Minnesota. (*Botanical Gazette*, vol. ix, p. 27; Feb., 1884.)

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*BUCHLOE, Engelmann. Flowers diœcious, heteromorphous.——*Male plant*. Spikes 1-sided, 2-ranked; spikelets 2- or 3 flowered. Glumes 2, 1-nerved, lower much smaller. Palets 2, of equal length, longer than the glumes; lower one 3-nerved, mucronate; upper one 2-nerved. Squamulæ in pairs, truncate, emarginate. Stamens 3; anthers linear. Rudiment of an ovary none.——*Female plant*. Spikes 1 to 3, short, capitate, oblique in the involucrate sheaths of the upper leaves; spikelets 1-flowered, crowded, upper floret abortive, withering. Glumes 2; lower glume of the lowest spikelets 1- to 3-nerved, lanceolate-subulate, with an herbaceous tip, or 2- or 3-cleft, lower side adnate to the back of the upper glume; lower glumes of the other spikelets (internal as to the head) free, much smaller, membranaceous, ovate-lanceolate, acute, 1-nerved; upper glumes (external) connate at the base with the thickened rachis, at length like a hard, woody involucre, ovate, nerveless, pale, trifid at the herbaceous, nerved tip. Lower palet (internal as to the head) shorter, 3-nerved, herbaceous, tricuspidate; upper palet shorter, 2-nerved. Squamulæ as in the male flowers. Rudiments of the stamens 3, minute. Ovary lenticular, glabrous, very short-stipitate; stigmas much longer than the 2 erect terminal styles, plumose with simple hairs, exsert from the apex of the flower. Caryopsis free, included in a horny, at length deciduous head, sublenticular, flat on the outside (toward the lower palet), convex on the inner side.

B. DACTYLOIDES, Engelmann. *Trans. Saint Louis Acad.*, vol, 1, p. 432, pl. 12 and 14. Densely tufted, spreading by stolons, forming broad mats; culms 3 to 6 inches long; flowering stems of the male plant 4 to 6 inches long, glabrous or slightly hairy; leaves 2 to 4 inches long, ½ to 1½ lines wide, nearly smooth; sheaths striate, glabrous, strongly bearded at the throat; spikes 3 to 6 lines long; spikelets alternate in 2 rows, uppermost abortive, bristle-form, 2 to 3 lines long; lower glume ovate-lanceolate, with a scarious margin; upper glume twice longer, ovate; lower palet convex, 3-nerved, upper one 2-nerved, two minute scales at the margin and inside of the lower palet; stamens 3. Stems of the female plant much shorter than the leaves, 1½ to 2 inches high; heads 3 to 3½ lines long; glumes becoming ligneous; spikes or heads usually 2; at maturity becoming thick, extremely hard, including the loose grain.——The celebrated "buffalo grass," known to hunters and trappers as one of the most nutritious grasses, on which for a part of the year subsist and fatten the immense herds of buffalo and the cattle of the hunter and emigrant. *Porter and Coulter's Flora of Colorado.*

†GRAPHEPHORUM FESTUCACEUM, Gray. (Festuca borealis, Mert. & Koch. Arundo festucacea, Willd.) Culm as thick as a swan's quill, 3 to 4 or more feet high; leaves 8 to 10 inches long, broadly linear-acuminate, rough to the touch. Panicle a foot and more long, almost quite erect, as well as the subverticillate slender branches.

DIARRHENA, Raf. DIARRHENA.

D. Americana, Beauv. Diarrhena.

[illegible] county, *Upham.* Rare south.

DACTYLIS, L. ORCHARD-GRASS.

D. glomerata, L. Orchard-Grass.

Ramsey county, *Oestlund.* Minneapolis, *Simmons.* Mankato, *Leiberg.*

KŒLERIA, Pers. KŒLERIA.

K. cristata, Pers. Kœleria.

Common or frequent throughout the state. [The most plentiful species of grass on the line of the Northern Pacific railroad in western Dakota, *Leiberg.*]

EATONIA, Raf. EATONIA.

E. obtusata, Gray. Eatonia.

Minneapolis, *Upham;* Blue Earth county, *Leiberg.* [Manitoba, *Macoun.*] South and west.

E. Pennsylvanica, Gray. Eatonia.

Throughout the state, excepting perhaps northwestward. Ramsey county, *Oestlund;* Minneapolis, *Upham;* Blue Earth county, *Leiberg;* New Ulm, *Juni.* [North of lake Superior, *Agassiz.*]

GLYCERIA, R. Br. MANNA-GRASS.

G. Canadensis, Trin. Rattlesnake-Grass.

Frequent throughout the state, excepting far southward. St. Croix river, *Parry;* Ramsey county, *Oestlund;* Minneapolis, *Simmons, Kassube.*

G. elongata, Trin. Manna-Grass.

Minneapolis, *Upham;* Blue Earth county, *Leiberg.* Infrequent.

G. nervata, Trin. Fowl Meadow-Grass.

Common throughout the state.

[G. pallida, Trin., doubtless occurs in this state, but has been overlooked.]

G. aquatica, Smith, var. **Americana,** Vasey. Reed Meadow-Grass.

Common throughout the state.

Spikelets erect, ½ to ¾ of an inch long, scattered or subfascicled, sessile or pedicellate, generally 4-flowered. Glumes unequal, convex, rounded at the back, not keeled, the outer one shorter than the florets, acute, entire at the point, the middle nerve reaching beyond the point, so as to form a short arista; there are besides, on each side, two short lateral nerves; the inner glume as long as the whole spikelet of florets, torn at the point, aristate, the middle nerve reaching beyond the point; there are besides 2 lateral nerves reaching to the apex, and 2 intermediate shorter ones. Florets cylindrical, closely placed, with a tuft of white hairs at the base of each; outer valve [palet] of the perianth jagged at the point, shortly aristate, with 7 nerves reaching to the summit; the inner lanceolate, the margin inflected, with 2 strong, green, ciliated nerves at the flexures, running out so as to form a bifid apex; upper floret smaller than the rest. *Hooker's Flora Borealis Am.,* II, 251.——The Iowa specimens, communicated by Mr. R. I. Cratty, agree fully with this description, except that the spikelets are not so large, scarcely exceeding ⅜ of an inch in length. Pedicels of the spikelets rough; awns formed by the nerves, especially of the glumes, inconspicuous, and sometimes barely observable. It grows 3 to 5 feet high in water, at the margin of lakes. *Arthur* in *Contributions to the Flora of Iowa, No. VI.*

G. fluitans, R. Br. Manna-Grass.

Common, or frequent, throughout the state.

POA, L. MEADOW-GRASS. SPEAR-GRASS.

P. annua, L. Low Spear-Grass.

Throughout the state, excepting perhaps far southward, but infrequent. Minneapolis, *Kassube;* Blue Earth county, *Leiberg.*

P. compressa, L. Wire-Grass.

Throughout the state, but infrequent. *Parry, Lapham.* Ramsey county, *Oestlund;* Blue Earth county, *Leiberg;* Pembina, *Chickering, Havard.*

P. alpina, L. Spear-Grass.

Isle Royale, and north shore of lake Superior, *Loring, Porter, Macoun;* doubtless also in Minnesota. North.

P. cæsia, Smith. Spear-Grass.

Throughout the state. North shore of lake Superior, *Juni;* Blue Earth county, *Leiberg;* Emmet county, Iowa, *Cratty.*

P. cæsia, Smith, var. **strictior,** Gray. Spear-Grass.

Isle Royale, *Whitney;* Red river, *Dawson. Macoun.* North.

P. serotina, Ehrh. False Red-top. Fowl Meadow-Grass.

Common throughout the state.

P. pratensis, L. Green or Common Meadow-Grass. Kentucky Blue-Grass. June Grass.

Common throughout the state; taking the place of the original prairie grasses in southwestern Minnesota, *Juni.* [In Nebraska not native, but spreading westward, *Aughey.*]

P. sylvestris, Gray. Spear-Grass.

Lapham. Pembina, *Havard.* Rare. South and west.

[P. debilis, Torr., probably occurs in this state.]

P. alsodes, Gray. Spear-Grass.

Saint Paul, *Kelley;* Red river valley, at Pembina, *Chickering.* Infrequent. South and west.

ERAGROSTIS, Beauv. ERAGROSTIS.

E. reptans, Nees. Eragrostis.

Through the south part of the state. *Lapham.* Goodhue county, *Oestlund;* Blue Earth county, *Leiberg.*

E. poæoides, Beauv., var. **megastachya,** Gray. Eragrostis.

Abundant, in door-yards and by road-sides, through the south half of the state; common north at least to Crow Wing, Todd and Grant counties, and in the Red river valley, *Upham.* It was found by *Geyer* in 1839 on sandy plains in the valley of the Sheyenne river, Dakota, and is quite probably indigenous in this region.

E. pilosa, Beauv. *Eragrostis.*

Blue Earth county, *Leiberg;* Minneapolis (distinct from E. Purshii), *Upham.* Infrequent. South.

E. Frankii, Meyer. Frank's Eragrostis.

Hastings, Dakota county, *Oestlund.* Southeast

E. Purshii, Schrader. Pursh's Eragrostis.

Becoming abundant by road-sides and in waste places, Ramsey county, Minneapolis, and Steele county, *Oestlund, Simmons, Upham*; determined by *Scribner, Vasey* and *Watson*. South.

E. capillaris, Nees. Eragrostis.

Lapham. Minneapolis, *Kassube*. Infrequent. South.

E. pectinacea, Gray. Eragrostis.

Lapham. Minneapolis, *Simmons*. South.

E. pectinacea, Gray, var. **spectabilis**, Gray. Eragrostis.

Minneapolis river bluff near the University;, *Oestlund, Upham*. South.

FESTUCA, L. Fescue-Grass.

F. tenella, Willd. Slender Fescue-Grass.

Through the south half of the state. *Lapham*. Minneapolis, *Simmons*, (abundant on sandy land east of the University) *Upham*

F. ovina, L. Sheep's Fescue.

Frequent throughout the state, excepting perhaps far southward.

F. rubra, L. (F. ovina, L., var. rubra, Gray.) Red Fescue.

Lake Superior, *Dr. Robbins*, and northward, Gray's *Manual*; probably in northern Minnesota.

[F. duriuscula, L. (F. ovina, L., var. duriuscula, Gray), should also be looked for northward.]

F. elatior, L. (Including *F. pratensis*, Hudson,) *Taller or Meadow Fescue.*

Minneapolis, old state farm close southeast from University, *Oestlund*. Infrequent.

F. nutans, Willd. Nodding Fescue.

Throughout the state, excepting perhaps far northward, but infrequent. Lake Winnibigoshish, *Houghton*; lake Minnetonka, *Oestlund*; Blue Earth county, *Leiberg*; Emmet county, Iowa (rare), *Cratty*.

BROMUS, L. Brome-Grass.

B. secalinus, L. *Cheat* or *Chess*.

Occasional in wheat-fields, mostly southeastward. A very unwelcome immigrant. Plentiful in Houston county, especially in fields of winter wheat, also frequent in mowing land, *J. S. Harris*; frequent, but not so plentiful as to be troublesome, in Steele county and at Minneapolis, *Upham*.

B. racemosus, L. *Upright Chess.*

Minneapolis, *Kassube*. Infrequent.

B. Kalmii, Gray. Wild Chess.

Common, or frequent, throughout the state, excepting perhaps northeastward.

B. ciliatus, L. Wild Chess.

Common, or frequent, throughout the state.

B. ciliatus, L., var. **purgans**, Gray. Wild Chess.

Minneapolis, *Upham*. Probably common.

PHRAGMITES, Trin. Reed.

P. communis, Trin. Reed.

Common, or frequent, in the edges of ponds and lakes, throughout the prairie portion of the state; also at Roseau lake and the lake of the Woods, *Dawson*.

SCHEDONNARDUS, Steudel.* SCHEDONNARDUS.

S. Texanus, Steud. (Lepturus paniculatus, Nutt.) Schedonnardus.

Rocky hills, Mound township, Rock county, *Leiberg*. [Upper Missouri river, *Geyer*.] Rare. Southwest.

LOLIUM, L. DARNEL. RAY-GRASS.

L. temulentum, L. *Bearded Darnel.*

Mankato (plentiful about the elevator of the St. Paul & Sioux City railroad), *Leiberg*.

AGROPYRUM, Beauv. (TRITICUM, L., in part.) WHEAT-GRASS.

A. repens, Beauv. (T. repens, L.) Couch-, Quitch-, Quick-, or Witch-Grass.

Frequent, or common, throughout the state, but rarely so plentiful as to be troublesome. (Specimens which must be referred to this species, as decided by *Mr. Sereno Watson*, were found at Minneapolis on the embankment of the railroad about an eighth of a mile northwest from the University and close west of Tuttle's brook, having a very narrow and long spike of many spikelets, awnless, as long or half as long as the joints of the rhachis, 3-flowered, with a rudiment of a fourth flower, often the lowest or the middle flower not ripening its grain, and having in some instances no running rootstocks. The typical T. repens occurs near by, and also forms which seem to be intermediate in respect to both the character of the spikes and the presence of rootstocks. *Upham*.)

A. dasystachyum, Vasey. (T. dasystachyum, Gray.) Wheat-Grass.

North shore of lake Superior, *Agassiz;* doubtless also in northern Minnesota.

A. violaceum, Vasey. (T. violaceum, Hornemann.) Wheat-Grass.

Throughout the state, but rarer than the next. Pembina, *Havard;* in openings of woods, on sandy modified drift, at the northwest side of Mille Lacs, *Upham*; Ramsey county, *Oestlund;* Emmet county, Iowa, *Cratty*.

A. caninum, Rœm. & Schultes. (T. caninum, L.) Wheat-Grass.

Frequent throughout the state, excepting perhaps far southward. Pembina, *Havard;* Minneapolis, *Twining*, *Upham;* Blue Earth county, *Leiberg*; New Ulm, *Juni*. [Between the James and Red rivers, Dakota, *Geyer*.]

HORDEUM, L. BARLEY.

H. jubatum, L. Squirrel-tail Grass.

Common, or frequent, throughout the state.

H. pusillum, Nutt. (H. pratense, Gray's *Manual*.) Barley-Grass.

Blue Earth county, *Leiberg*. Rare. South.

ELYMUS, L. LYME GRASS. WILD RYE.

E. Virginicus, L. Wild Rye.

Frequent throughout the state ; less common than the next.

E. Canadensis, L. Nodding Wild Rye.

Common throughout the state.

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*SCHEDONNARDUS, Steudel. Spikelets one-flowered, solitary at each joint of the slender triangular rhachis of the paniculate spikes, and partly immersed in an excavation ; the spikes alternate and distant ; outer glumes acuminate, unequal, the longer equaling the flowering glume, which is linear-acuminate, and thickish at the keel ; palet shorter and thinner. *Vasey's Grasses of U. S.*

E. Canadensis, L., var. **glaucifolius**, Gray. Nodding Wild Rye.

Throughout the state. Lake of the Woods (sandy shore), *Dawson*; Martin county, and Emmet county, Iowa, *Cratty*.

E. Sibiricus, L. Wild Rye.

Red river valley, at Pembina, *Havard*. North.

E. striatus, Willd. Wild Rye.

Throughout the state. St. Croix river, *Houghton;* Ramsey county, *Oestlund;* Minneapolis, *Simmons;* Blue Earth county, *Leiberg;* New Ulm, *Juni;* Martin county (plentiful), *Cratty*. [Lake Superior, *Whitney;* Manitoba, *Macoun*.]

E. striatus, Willd., var. **villosus**, Gray. Wild Rye.

Also throughout the state. Pembina, *Havard;* lake Minnetonka, *Roberts;* Blue Earth county (frequent), *Leiberg*.

E. mollis, Trin. Wild Rye.

Lake shores [probably lake Superior], Minnesota, Wood's *Class-Book*. [North of lake Superior, *Agassiz*.]

E. Sitanion, Schultes.* Wild Rye.

From northern Minnesota to Texas and west to California, *Watson;* Blue Earth county and westward, *Leiberg*. West.

ASPRELLA, Willd. (GYMNOSTICHUM, Schreb.) BOTTLE-BRUSH GRASS.

A. Hystrix, Willd. (G. Hystrix, Schreb.) Bottle-brush Grass.

Common, or frequent, throughout the state.

DANTHONIA, DC. WILD OAT-GRASS.

D. spicata, Beauv. Wild Oat-Grass.

Throughout the state, but mostly infrequent. Lake of the Woods, *Dawson;* Stearns county, etc., *Upham;* Pipestone county, *Mrs. Bennett*.

AVENA, L. Oat.

A. fatua, L.† *Wild Oats.*

Ramsey county (new state farm and adjoining land, growing in grain-fields and on waste ground, apparently naturalized and spreading), *Oestlund*. Extensively naturalized in California; also found in Texas and Wisconsin, in the latter state becoming very troublesome in oat-fields, *Vasey;* but not yet reported (so far as known to the writer) in other portions of the United States east of the Rocky mountains. Its seeds ripen early and mostly fall before harvest, rendering its extermination more difficult. It is supposed to be the original of the cultivated oat (*A. sativa*, L.).

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*ELYMUS SITANION, Schultes. Culms 4 inches to 2 feet high, tufted, and with the leaves and sheaths glabrous or somewhat pubescent or scabrous; spike erect, 1 to 3 inches long, squarrose with its long recurved awns, jointed and fragile at maturity; spikelets in pairs, 2- to 5-flowered, smooth or puberulent; glumes entire or usually parted to the base and the segments unequally 2-cleft, the divisions long-awned (1 to 3 inches); flowers 3 lines long, the awn of the lower palet equaling that of the glumes, with often a subsidiary awn or tooth on each side at the apex of the palet. A very variable grass. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*

†*Avena fatua*, L. An erect annual, 2 or 3 feet high, smooth except at the hairy nodes, with flat slightly scabrous leaves and loose sheaths: panicle 8 to 10 inches long, the few-flowered rays spreading equally; spikelets about an inch long, the scarious pointed glumes longer than the florets, often purplish at base: lower palet about 6 lines long, firm at base, scabrous and covered with long brown hairs, its lobes tapering to a sharp point; awn about twice the length of palet, bent near the middle and twisted below: grain very hairy. *Thurber* in *Botany of California*.

A. striata, Michx. Oat-Grass.

Throughout the state, excepting perhaps far southward. Isanti county, etc. (frequent), *Upham;* New Ulm, *Juni.*

A. Smithii, T. C. Porter. Oat-Grass.

Isle Royale, and eastward about lake Superior, Gray's *Manual;* probably also north of this lake in Minnesota.

TRISETUM, Persoon. TRISETUM.

T. subspicatum, Beauv., var. **molle,** Gray. Trisetum.

North of lake Superior (common), *Macoun.*

DESCHAMPSIA, Beauv. (AIRA, L., in part.) HAIR-GRASS.

D. cæspitosa, Beauv. (A. cæspitosa, L.) Hair-Grass.

Throughout the state, excepting perhaps far southward, but infrequent. Blue Earth county, *Leiberg.*

[D. flexuosa, Beauv. (A. flexuosa, L.), probably also occurs in this state.]

ARRHENATHERUM, Beauv. OAT-GRASS.

A. avenaceum, Beauv. *Tall Oat-Grass.*

New state farm, Ramsey county, *Oestlund.* Infrequent.

HIEROCHLOA, Gmelin. HOLY GRASS.

H. borealis, Rœm. and Schultes. Vanilla or Seneca Grass.

Common, or frequent, throughout the state.

PHALARIS, L. CANARY-GRASS.

P. Canariensis, L. *Canary-Grass.*

Occasionally adventive: Minneapolis, *Simmons, Upham;* Waterville, Le Sueur county, *Oestlund.*

P. arundinacea, L. Reed Canary-Grass.

Common, or frequent, throughout the state.

[Milium effusum, L., probably occurs in this state, but has been overlooked.]

BECKMANNIA, Host. BECKMANNIA. BECKMANN'S GRASS.

B. erucæformis, Host.* Beckmann's Grass.

Lapham. Pipestone quarry (growing in the hollows of the rock, where water occasionally stands), *Leiberg.* [James river, Dakota, *Geyer;* and north to the Saskatchewan river and Bear lake, *Watson.*] Rare. West.

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*BECKMANNIA, Host. Panicle racemose, contracted. Spikelets compressed, 2-flowered, the upper floret an abortive rudiment. Glumes 2, obovate, compressed-boatshaped, subcoriaceous, equal, a little shorter than the flower, pointless. Palets membranous, the lower ovate, concave, acutish, mucronate, 3-nerved, the upper 2-nerved, bifid. Stamens 3. Styles 2, with elongated plumose stigmas. Scales 2, bifid, glabrous. Grain free, glabrous.—A coarse perennial aquatic.

B. ERUCÆFORMIS, Host. Culms stout, 1 to 3½ feet high, erect from an ascending base, with the sheaths glabrous; ligules elongated; leaves linear, 4 to 8 inches long and 2 to 6 lines wide, flat, acute, scabrous; panicle 4 to 12 inches long, erect, strict, secund, the short crowded branchlets densely flowered from the base, glabrous; spikelets sessile, imbricately arranged in two rows, nearly orbicular, 1¼ lines in diameter, the upper rudimentary floret minute, stipitate. June to September. *Watson's Rep. in King's Expl. of the Fortieth Parallel.*

PANICUM, L. PANIC-GRASS.

P. glabrum, Gaudin. *Smooth Finger-Grass.*

Minneapolis (plentiful), *Simmons, Upham;* Blue Earth county, *Leiberg.*

P. sanguinale, L. *Common Crab-* or *Finger-Grass.*

Minneapolis, *Kassube;* Blue Earth county, *Leiberg.*

P. agrostoides, Spreng. Panic-Grass.

Lapham. Ramsey and Hennepin counties, *Oestlund.* South.

P. capillare, L. Old-witch Grass.

Common throughout the state. Late in autumn "the spreading panicle is easily broken off and blown about by the wind."

P. autumnale, Bosc. Panic-Grass.

Lapham. New Ulm, *Juni.* Rare. South.

P. virgatum, L. Panic-Grass.

Abundant southwestward and in the Red river valley; frequent southeastward. "Nowhere so luxuriant as near the upper Des Moines river and Spirit lake," *Geyer, Torrey.*

P. latifolium, L. Panic-Grass.

Through the south half of the state, but infrequent. Minnesota river, *Parry;* Blue Earth county, *Leiberg;* Minneapolis, *Simmons;* Anoka county, etc., *Upham.*

[P. clandestinum, L., probably also occurs in this state.]

P. xanthophysum, Gray. Panic-Grass.

Throughout the state. Minneapolis, *Kassube;* Steele and Isanti counties, *Upham.* [Manitoba, *Macoun;* also in the catalogues of Wisconsin, Iowa aud Nebraska.]

P. consanguineum, Kunth, var. **latifolium**, Vasey, ined.* Panic-Grass

New state farm, Ramsey county, *Oestlund.* Probably frequent; resembling P. xanthophysum, so that perhaps some of the references under that species belong instead to this.

P. pauciflorum, Ell. Panic-Grass.

Throughout the state, excepting perhaps northeastward. Red river (swampy prairie), *Dawson;* Ramsey county, *Oestlund;* Minneapolis, *Upham;* Blue Earth county, *Leiberg;* Emmet county, Iowa (common), *Cratty.*

P. dichotomum, L. Panic-Grass.

Common, or frequent, throughout the state. [Specimens collected in early summer by *Mr. Oestlund* on the new state farm, Ramsey county, are regarded by *Dr. Vasey* as representing the typical form of this species. It occurs intermingled with other grasses on lowlands: mainly smooth; culms slender, 1½ feet high; panicle long-peduncled.]

P. dichotomum, L., var. **pubescens**, Vasey, ined. (P. pubescens, Lam.) Panic-Grass.

Ramsey and Hennepin counties (usually about a foot high, becoming much branched), *Oestlund, Upham;* probably the more common form of the species in this state. Gray's *Manual* characterizes it as "a shaggy-hairy and larger-flowered variety." [Culm rather leafy, 1 to 2 feet high; leaves and sheaths decidedly pubescent or villous. *Letter of Dr. Vasey*, Sept. 30, 1884.]

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*PANICUM CONSANGUINEUM, Kunth. Smooth or villous; culms (1 to 1½ feet high) at length excessively branched: leaves linear, erect; panicle long-peduncled, the flexuous widely spreading branches few-flowered; spikelets obovate, pale, pubescent; upper glume 7-nerved; upper palea of the neutral flower none; perfect flower acute. *Chapman's Flora of the Southern States*, appendix, p. 667.——Var. LATIFOLIUM, Vasey, ined. Culms weaker, leaves wider, and flowers more pubescent. Minnesota, *Oestlund*. *Letter of Dr. Vasey*, Sept. 30, 1884.

[Two others of the forms included under P. dichotomum in Gray's *Manual*, but separated from it by appendix of Chapman's *Flora of the Southern States*, with the descriptions here quoted, are recognized by Dr. Vasey (*Grasses of U. S.*) as distinct species, namely, P. LAXIFLORUM, Lam. (culms tufted, smooth, 6 to 12 inches high; leaves lanceolate, acuminate, ciliate, mostly pale yellowish-green, 2 to 3 inches long, the villous sheaths shorter than the internodes; panicle diffuse, plumose-bearded, rather few-flowered; spikelets scattered, oval, densely pubescent, the upper glume 7-nerved; neutral flower bipaleaceous; fertile flower acute: on dry sandy ground), and P. RAMULOSUM, Michx., in part (low, 6 to 8 inches high, tufted, very smooth and shining; culm mostly purple; leaves linear; panicle 1¼ to 2 inches long, diffusely branched, many-flowered; spikelets minute, purple, very smooth, the upper glume and neutral palet 5-nerved: in sandy woodlands); both of which are common in the eastern states, but have not yet been observed so far northwestward as Minnesota.]

P. depauperatum, Muhl. Panic-Grass.

Throughout the state. *Lapham.* Blue Earth county, *Leiberg;* Emmet county, Iowa, *Cratty*. [Lake Superior, *Whitney*; Manitoba, *Macoun*.]

P. Crus-galli, L. *Barnyard-Grass.*

Common throughout the state.

P. Crus-galli, L., var. **hispidum**, Gray. Cockspur Grass.

Rock and Pipestone counties, etc. (frequently seen attaining a very rank growth beside roads where they cross creeks or boggy land, apparently indigenous), *Leiberg.*

SETARIA, Beauv. Bristly Fox-tail Grass.

S. verticillata, Beauv. *Bristly Fox-tail Grass.*

Mankato, *Leiberg*. Rare.

S. glauca, Beauv. "*Pigeon-Grass.*" *Foxtail.*

Common, often abundant, throughout the state.

S. viridis, Beauv. "*Pigeon-Grass.*" *Green Foxtail. Bottle-Grass.*

Also common, or abundant, in cultivated ground, with the last.

S. Italica, Kunth. *Millet. Bengal-Grass.*

Becoming a bad weed in flax-fields in the southern part of the state, *Leiberg;* New Ulm, *Juni.*

CENCHRUS, L. Hedgehog-Grass. Bur-Grass.

C. tribuloides, L. "Sand-bur." Hedgehog-Grass. Bur-Grass.

Common, or frequent, in sandy lands along the Mississippi and Minnesota rivers. (Occasionally attacked by smut, as at Minneapolis in 1884.)

ANDROPOGON, L. Beard-Grass.

A. furcatus, Muhl. "Blue-Joint." Beard-Grass. Forked Spike.

Common, or abundant, throughout the prairie region of the state; extending northeast at least to Crow Wing county, *Upham*, and the lake of the Woods, *Dawson*. Highly esteemed for hay; southwestward it is usually called "Blue-Joint," a name which properly belongs to Deyeuxia Canadensis.

A. scoparius, Michx. Beard-Grass. Broom-Grass.

Common, with same range as the last.

CHRYSOPOGON, Trin.* Chrysopogon. Beard-Grass.

C. nutans, Benth. (Sorghum nutans, Gray.) Indian Grass. Wood-Grass.

Common, with same range as the two last; making good hay.

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* CHRYSOPOGON, Trin. Flowers loosely paniculate. Fertile spikelets one-flowered,

EQUISETACEÆ. HORSETAIL FAMILY.

EQUISETUM, L. HORSETAIL. SCOURING-RUSH.

[E. Telmateia, Ehrh., probably occurs in this state north of lake Superior.]

E. arvense, L. Common Horsetail.

Common throughout the state.

E. pratense, Ehrh. Meadow Horsetail.

Throughout the state, excepting perhaps far southward. Morrison county. *Upham;* Stearns county. *Campbell;* Saint Paul, *Kelley.*

E. sylvaticum, L. Wood Horsetail

Throughout the state: common northward, but infrequent far southward.

[E palustre, L., will probably be found in the north part of the state.]

E. limosum, L. Swamp Horsetail.

Common, or frequent, throughout the state.

E. lævigatum, Braun. Horsetail.

Minneapolis, *Simmons, Upham;* Red river, near Saint Vincent, *Dawson, Scott.* South and west.

E. hiemale, L. Scouring-Rush. Shave-Grass.

Common throughout the state; very abundant along the banks of the Minnesota river, *Parry.*

E. variegatum, Schleicher. Horsetail.

Throughout the state, excepting perhaps far southward. Near the Mississippi river, Anoka county, *Upham;* Minneapolis, *Simmons.* Infrequent.

E. scirpoides, Michx. Horsetail.

Range like the last, also infrequent. *Lapham.* Deep woods, St. Croix river, *Parry.*

FILICES. FERNS.

POLYPODIUM, L. POLYPODY.

P. vulgare, L. Common Polypody.

Abundant, or common, through the north half of the state; frequent southeastward, on the rocky bluffs of the St. Croix, Mississippi and Minnesota rivers, and their tributaries; rare southwestward.

ADIANTUM, L. MAIDENHAIR.

A. pedatum, L. American Maidenhair.

Frequent, in many places common or abundant, throughout the state.

PTERIS, L. BRAKE OR BRACKEN.

P. aquilina, L. Common Brake. Bracken. Eagle Fern.

Common, or frequent, throughout the state.

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branches of the panicle, with, sometimes, one to three pairs of spikelets on the branch below the terminal three. Fertile spikelets with the lower glume larger and coriaceous; the second narrower, thick, keeled, pointed or awned; the third hyaline and empty; the fourth or flowering glume hyaline and awned. Palet minute or none. *Vasey's Grasses of U. S.*

CHEILANTHES, Swartz. Lip-Fern.

C. lanuginosa, Nutt. Lip-Fern.

Lapham, Miss Cathcart. Falls of the St. Croix, *Parry.* Rare.

PELLÆA, Link. Cliff-Brake.

P. gracilis, Hook. Slender Cliff-Brake.

Throughout the state, but rare. Blue Earth river, and head of lake St. Croix, *Parry;* Saint Paul (rare), *Miss Cathcart;* cliffs forming the right bank of the Mississippi in Minneapolis, also at Minneopa falls, Blue Earth county, *Leiberg;* lake Pepin, *Miss Manning;* Martin county, and Emmet county, Iowa (rare), *Cratty.*

P. atropurpurea, Link. Clayton's Cliff-Brake.

Throughout the state, but infrequent. Stillwater, *Miss Field;* Saint Paul, *Miss Cathcart;* Hastings, *Oestlund;* lake Pepin, *Miss Manning;* Blue Earth county, *Leiberg.*

CRYPTOGRAMME, R. Br. (Allosorus, Bernhardi, in part.) Rock-Brake.

C. acrostichoides, R. Br. (Allosorus acrostichoides, Sprengel.) Rock-Brake.

Isle Royale, lake Superior, thence westward and northward, Gray's *Manual;* doubtless in Minnesota.

ASPLENIUM, L. Spleenwort.

A. Trichomanes, L. Maidenhair Spleenwort. Dwarf Spleenwort.

Burnt Portage, Dawson road, near the northern boundary of Minnesota, *Macoun;* Taylor's Falls, *Miss Cathcart;* Lake City, *Mrs. Ray.* Throughout the state, but infrequent.

A. ebeneum, Ait. Ebony Spleenwort.

Taylor's Falls, *Miss Cathcart.* Rare. [Nebraska, *Aughey.*]

[A. Ruta-muraria, L., and A. angustifolium, Michx., should be looked for in this state.]

A. thelypteroides, Michx. Silvery Spleenwort.

St. Croix river, *Parry;* Stillwater, *Miss Field;* lake Pepin, *Miss Manning;* Blue Earth county, *Leiberg.* East.

A. Filix-fœmina, Bernh. Lady-Fern.

Common (having diverse forms, but probably not permanent varieties) in woodlands throughout the state.

CAMPTOSORUS, Link. Walking-Leaf. Walking-Fern.

C. rhizophyllus, Link. Walking-Leaf. Walking-Fern.

Throughout the state, but rare. Rocks, upper Mississippi river, *Geyer;* falls of the St. Croix, *Parry;* Taylor's Falls and Duluth, *Miss Cathcart;* Stillwater, *Miss Field;* Red Wing, *Oestlund;* lake Pepin, *Miss Manning.* [Manitoba, *Macoun;* Nebraska, *Aughey.*]

PHEGOPTERIS, Fée. Beech-Fern.

P. polypodioides, Fée. Common Beech-Fern.

Abundant north of lake Superior, *Roberts;* extending south to the St. Croix river, *Parry;* Taylor's Falls (plentiful), *Miss Cathcart.* [Manitoba, *Macoun;* Nebraska,

P. hexagonoptera, Fée. Hexagon Beech-Fern.

Duluth (plentiful), *Miss Cathcart;* and through the south half of the state, but rare.

P. Dryopteris, Fée. Oak-Fern.

North of lake Superior (common), *Roberts;* St. Louis river, *Mrs. Herrick;* St. Croix river, *Parry, Miss Field;* Taylor's Falls (plentiful), Saint Paul (rare), *Miss Cathcart.* [Manitoba, *Macoun.*]

P. calcarea, Fée.* (P. Dryopteris, Fée, var. Robertianum, Davenport.) Beech-Fern.

"Collected in eastern Minnesota, growing on slaty rocks on the [west] bank of the St. Louis river, near [close north of] the crossing of the Northern Pacific Railway, by *Miss Ellen W. Cathcart.* Formerly attributed to America, but not clearly known as American till now. It is rather common in Europe, and has been found in the Himalayan regions of Asia. It will probably be found from Lake Superior to Idaho. This fern is very closely related to the common P. Dryopteris, and is often considered a variety of it." *Eaton's Ferns of North America* : 1880 ; vol. ii, p. 277. Since this was written, a second locality of this fern has been discovered by *Mr. E. W. Holway* at Decorah, Iowa, where it occurs only upon a space about six feet square, "in the crevices of the north side of a limestone bluff." *Arthur* ; *Bulletin of Torrey Botanical Club,* vol. ix, p. 50. Still more recently it has been collected by *Prof. J. Macoun* in Anticosti island, and by *Drs. G. M. Dawson* and *R. Bell* in the country around and to the east of the lake of the Woods. *Science,* vol. iii, p. 676 (June 6, 1884).

ASPIDIUM, Swartz. SHIELD-FERN. WOOD-FERN.

A. Thelypteris, Swartz. Marsh Shield-Fern.

Common, or frequent, throughout the state.

A. Noveboracense, Swartz. New York Shield-Fern.

Stearns county, *Campbell;* lake Pepin, *Miss Manning.* Infrequent. East.

A. fragrans, Swartz. Fragrant Wood-Fern.

Isle Royale, *Dr. Lyons;* Duluth and Taylor's Falls, *Miss Cathcart;* Kettle river in T. 42, R. 20, Pine county, *Upham;* falls of the St. Croix, *Parry;* Pipestone quarry, *Mrs. Bennett.* [Nebraska, *Aughey.*] North and southwest.

A. spinulosum, Swartz. Spinulose or Common Wood-Fern.

Throughout the state, but rare. *Lapham.* Duluth, *Miss Cathcart;* lake of the Woods, *Dawson.*

A. spinulosum, Swartz, var. **intermedium,** Eaton. Spinulose or Common Wood-Fern.

Common, or frequent, throughout the state, excepting far southward. Ramsey county, *Simmons;* Pine county, etc., *Upham.* [North of lake Superior, *Agassiz;* Nebraska, *Aughey.*]

A. spinulosum, Swartz, var. **dilatatum,** Hornemann. Spinulose or Common Wood-Fern.

Throughout the state, excepting far southward. Falls of the St. Croix, *Parry;* Duluth, *Miss Cathcart;* Cascade river, north of lake Superior, *Roberts.* [Manitoba, *Macoun;* Nebraka, *Aughey.*]

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*PHEGOPTERIS CALCAREA, Fee. Rootstock slender, cord-like, widely creeping; stalks scattered, slender, glandular, chaffy near the base, six to twelve inches high; fronds herbaceous, rather rigid, minutely glandular, deltoid, four to eight inches long and about as broad at the base, ternate; primary divisions stalked, pinnate with oblong or ovate-oblong pinnæ, which are pinnately lobed or divided; lowest inferior pinna of the lateral divisions about equal to the third pinna of the middle division; lobes oblong, obtuse, crenately toothed, or if very large, pinnately lobed; veins pinnately branched, sori small, nearer the margin than the midvein. *Eaton's Ferns of N. A*

A. Boottii, Tuckerman. (A. spinulosum, Swartz, var. Boottii, Gray.) Boott's Wood-Fern.

Kanabec county, *Upham.* Infrequent.

A. cristatum, Swartz. Crested Wood-Fern.

Throughout the state; frequent northward, rare southward. St. Croix river, *Parry;* Minneapolis, *Simmons;* Saint Paul and lake Harriet (near Minneapolis), *Miss Cathcart;* Blue Earth county, *Leiberg.* [Extending northwest to lake Winnipeg, *Eaton;* Nebraska, *Aughey.*]

A. Goldianum, Hook. Goldie's Wood-Fern.

Minnesota, *Davenport;* Minneopa falls, Blue Earth county, *Leiberg.* Rare. East.

A. Filix-mas, Swartz. Male-Fern.

North shore of lake Superior, near Beaver Bay, *Campbell.* Rare. North.

A. marginale, Swartz. Marginal Shield-Fern. Evergreen Wood-Fern.

Lapham, Davenport. Infrequent. [Nebraska, *Aughey.*]

A. acrostichoides, Swartz. Christmas-Fern.

Lapham, Miss Cathcart. Fort Snelling, *Parry.* East.

A. Lonchitis, Swartz. Holly-Fern.

South of lake Superior, *Whitney;* doubtless also north of this lake in Minnesota. [Nebraska, *Aughey.*]

[A. aculeatum, Swartz, var. Braunii, Doell, will also probably be found in the northeast part of this state.]

CYSTOPTERIS, Bernhardi. BLADDER-FERN. CYSTOPTERIS.

C. bulbifera, Bernh. Bulblet Cystopteris.

Frequent, or common, throughout the state.

C. fragilis, Bernh. Brittle Fern.

Also frequent, or common, throughout the state. Very variable; the form named var. dentata, Hook., has been observed at Cascade river, north of lake Superior, *Roberts;* Taylor's Falls, *Miss Cathcart;* and in Iowa (common), *Arthur.*

C. montana, Bernh. Bladder-Fern. Cystopteris.

In a swamp at the silver mine three miles up the bay from Port Arthur, *Macoun;* probably also to be found north of lake Superior in Minnesota. [Deltoid-ovate, delicately tripinnate, and almost quadripinnate fronds, and a long, slender, creeping rootstock. *Eaton* in *Wheeler's Report of Surveys west of the One Hundredth Meridian.*]

ONOCLEA, L. SENSITIVE FERN.

O. Struthiopteris, Hoff. (Struthiopteris Germanica, Willd.) Ostrich-Fern.

Common, or frequent, throughout the state, excepting southwestward.

O. sensibilis, L. Sensitive Fern.

Common throughout the state, excepting perhaps near its west side. (A frond eighteen inches high, sterile on one side of the stipe, but wholly fertile on the other side, was found by the writer in Todd county The form called var. obtusilobata, Torr., has been noted at Taylor's Falls, *Miss Cathcart,* and Mankato, *Gedge.*)

WOODSIA, R. Br. WOODSIA.

W. obtusa, Torr. Obtuse Woodsia.

Throughout the state, but local. Taylor's Falls [falls of the St. Croix], *Parry,* (abundant) *Miss Cathcart*, *Miss Field;* Rock county, *Leiberg;* Pipestone quarry, *Mrs. Bennett.* [Manitoba, *Macoun;* Nebraska, *Aughey.*]

W. Ilvensis, R. Br. Rusty Woodsia.

Throughout the state, excepting far southward. North of lake Superior (abundant), *Roberts;* lake of the Woods, *Dawson;* Taylor's Falls and Duluth (common), *Miss Cathcart, Miss Field;* Stearns county, *Mrs. Blaisdell;* upper Minnesota river, *Parry;* Redwood Falls, *Miss Butler.* "A dwarf form, one to three inches high, yet fruiting freely, was common in the clefts of the rocks on the summit of Carlton's Peak." *Roberts.*

[W. hyperborea, R. Br., found by *Prof. Macoun* on the north shore of lake Superior, should be looked for in northern Minnesota. It is nearly related to W. Ilvensis, but is tenderer in its texture, much less chaffy, and narrower in outline, with shorter, more obtuse, and less divided pinnæ. *Eaton's Ferns of N. A.*]

W. glabella, R. Br. Smooth Woodsia.

North of lake Superior (at Kakabeka falls), *Macoun;* doubtless also to be found in northern Minnesota; Stillwater, *Miss Field.*

W. Oregana, Eaton. Oregon Woodsia.

South shore of lake Superior and westward [Keweenaw peninsula and lake Winnipeg]; doubtless in northern Minnesota; also at Stillwater, *Miss Field.*

W. scopulina, Eaton.* Rocky Mountain Woodsia.

Collected by *Miss Cathcart* at Duluth, and at Taylor's Falls on the St. Croix river; Lyons creek below Minneopa falls, Blue Earth county, *Gedge.* "Growing in dense masses on rocks and in crevices, from Oregon to Mono Pass, California, and extending eastward to Dacotah, Minnesota and Colorado. . . . The largest specimens are from Minnesota and Colorado." *Eaton's Ferns of North America.*

DICKSONIA, L'Her. DICKSONIA.

D. pilosiuscula, Willd. (D. punctilobula, Kunze.) Fine-haired Mountain Fern. Hay-scented Fern.

Miss Cathcart. Stearns county, *Campbell;* lake Pepin, *Miss Manning.* Rare. Southeast.

OSMUNDA, L. FLOWERING FERN.

O. regalis, L. Royal-Fern. Flowering Fern.

Frequent throughout the state, excepting far southward. North of lake Superior (common along Devil's Track river), *Roberts;* Anoka county, etc., *Upham;* Saint Paul and northward, *Miss Cathcart, Miss Field.*

O. Claytoniana, L. Clayton's (Interrupted) Flowering Fern.

Common, or frequent, throughout the state.

O. cinnamomea, L. Cinnamon-Fern.

Throughout the state, excepting perhaps northwestward. Common north of lake Superior and at Minneapolis, *Roberts;* Anoka county, etc., *Upham;* Taylor's Falls, *Miss Cathcart, Miss Field;* Northfield, Rice county, *Chaney;* lake Pepin, *Miss Manning.*

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*WOODSIA SCOPULINA, Eaton. Root-stocks short, creeping, chaffy, forming large tufts or patches; stalks two to four inches high, not jointed, bright ferruginous near the base, paler and stramineous upwards, puberulent like the rachis and the under surface of the frond, with minute jointed hairs and stalked glands; fronds lanceolate-oblong, four to eight inches long, pinnate; pinnæ numerous, eight to fifteen lines long, oblong-ovate, sub-acute, deeply pinnatifid with five to eight pairs of short ovate or oblong obtuse crenulate or toothed divisions; sori sub-marginal; indusium very delicate, deeply cleft into narrow segments which terminate in short hairs composed of irregular cylindrical cells. . . . Nearly like W. Oregana. *Eaton's Ferns of N. A.*

OPHIOGLOSSACEÆ. ADDER'S-TONGUE FAMILY.

BOTRYCHIUM, Swartz. GRAPE-FERN. MOONWORT.

B. Lunaria, Swartz. Moonwort.

North shore of lake Superior, *Macoun;* doubtless to be found in northern Minnesota.

B. simplex, Hitchcock. Hitchcock's Grape-Fern.

Thomson, Carlton county (rare), *Miss Cathcart.* [Abundant at Fort William, north of lake Superior, *Macoun.*] North.

[B. lanceolatum, Angstrœm, and B. matricariæfolium, Braun, probably occur in northeastern Minnesota. The latter is distinguished from B. lanceolatum by having the sterile segment petioled, diverging but little and embracing the fertile when young, oblong and only in the largest plants deltoid, with its divisions and lobes oblong or ovate and obtuse; panicle with stalk usually half as long as the sterile segment, and sometimes longer than it; and by its fruiting two or three weeks earlier. *Eaton's Ferns of N. A.*]

B. Virginianum, Swartz. Virginia Grape-Fern. Rattlesnake Fern.

Frequent, or common, throughout the state.

B. ternatum, Swartz. (B. lunarioides, Swartz. B. australe, R. Br.) Ternate Grape-Fern.

Throughout the state, but infrequent. St. Croix river, *Parry;* St. Croix Falls (rare), *Miss Field;* lake Pepin, *Miss Manning;* near Lake Crystal (station now obliterated), *Leiberg;* lake of the Woods at mouth of Rainy river, *Dawson.* [Var. obliquum, Milde, and var. dissectum, Milde, probably also occur in this state.]

OPHIOGLOSSUM, L. ADDER'S TONGUE.

O. vulgatum, L. Adder's-Tongue.

Lake of the Woods at mouth of Rainy river, with the last, *Dawson.* Rare.

LYCOPODIACEÆ. CLUB-MOSS FAMILY.

LYCOPODIUM, L. CLUB-MOSS. TRAILING EVERGREEN.

L. lucidulum, Michx. Shining Club-Moss.

Mouth of Devil's Track river, lake Superior, and on Carlton's Peak (abundant), *Roberts;* lake of the Woods, *Dawson;* Kettle river, Pine county (common), *Upham;* St. Croix river, *Parry;* Blue Earth county, *Leiberg.* [Hesper, Iowa, *Mrs. Carter;* the sole species of this genus, and its only locality, known in Iowa, *Arthur.*] North.

L. Selago, L. Fir Club-Moss.

North shore of lake Superior, *Juni, Roberts.* Rare. North.

L. inundatum, L. Marsh Club-Moss.

Palisades, north shore of lake Superior, *Juni;* Stillwater, *Miss Butler.* North.

L. annotinum, L. Club-Moss.

Common through the north part of the state; extending southwestward to Pine county (common), *Upham,* and the sources of the Mississippi, *Houghton.*

L. dendroideum, Michx. Tree-like Club-Moss. Ground-Pine.

Common northward, extending southwest to Wadena county; the most plentiful

L. clavatum, L. Common Club-Moss.

Common northward, extending thus south at least to Pine county.

L. complanatum, L. Club-Moss. Festoon Ground-Pine.

Common northward; extending south to Wadena and Pine counties (next in abundance after L. dendroideum, Michx.), *Upham*. This and the three species next preceding are bounded within nearly the same limits as the pines, spruce and fir.

L. complanatum, L., var. **sabinæfolium**, Spring. Club-Moss. Ground-Fir.

Frequent far northward; upper Mississippi river, *Garrison*.

SELAGINELLEÆ.

SELAGINELLA, Beauv. DWARF CLUB-MOSS. SELAGINELLA.

S. selaginoides, Link. Dwarf Club-Moss.

Isle Royale, *Dr. Lyons*; north shore of lake Superior, *Macoun*; doubtless to be found in northern Minnesota.

S. rupestris, Spring. Dwarf Club-Moss.

Throughout the state. Lake of the Woods, *Dawson*; Morrison, Benton and Stearns counties, *Upham*; upper Minnesota river and falls of the St. Croix, *Parry*; Blue Earth county, *Leiberg*; Redstone, near New Ulm, *Juni*; Redwood Falls, *Miss Butler*; Pipestone quarry, *Mrs. Bennett*.

[S. apus, Spring, will probably be found in the south part of the state.]

[Isoetes lacustris, L., I. echinospora, Durieu, var. Braunii, Engelm., I. riparia, Engelm., and I. melanopoda, J. Gay, should be looked for in this state.]

MARSILIACEÆ.

MARSILIA, Lam. MARSILIA.

M. vestita, Hook. & Grev.* Marsilia.

"Dry swamps in the prairies near Devil's lake," in northeastern Dakota, *Geyer*; "near the Mississippi river," in Iowa, *Dr. Cousens*; probably also in Minnesota. (See notes on this species in *Arthur's Contributions to the Flora of Iowa, No. VI.*)

[Prof. Eaton writes that the Marsilia cited as collected by Geyer is the original of M. mucronata, Braun; but it is regarded by Prof. Eaton as a form of M. vestita, as at first determined by Dr. Torrey, differing from the ordinary type in having longer peduncles and less hairy sporocarps. M. uncinata, Braun, is found, according to Prof. Eaton, in Texas, Louisiana and Florida.]

SALVINIACEÆ.

AZOLLA, L. AZOLLA.

A. Caroliniana, Willd. Azolla.

Lapham. [The range of this species is stated by *Prof. Eaton* in the *Botany of California* to be from "Oregon to Arizona, eastward to the Atlantic, and southward to Brazil."]

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*MARSILIA VESTITA, Hook. & Grev. Leaflets broadly cuneate, usually hairy, entire, 2 to 7 lines long and broad; petioles 1 to 4 inches long; peduncles free from the petiole; sporocarps solitary, short-peduncled, about 2 lines long, very hairy when young; upper tooth longest, acute, straight or curved; lower tooth obtuse, the sinus between them rounded. . . . Oregon to Texas. *Eaton* in *Botany of California*.

APPENDIX.

Since the date of the acknowledgments made on page 10, contributions to this catalogue have been received from Mrs. C. L. Herrick, of Minneapolis; Mr. A. W. Jones, of the state university; Mr. W. H. Kelley, of Saint Paul; and Mr. O. W. Oestlund, of Minneapolis. Three varieties of grasses, described by Dr. Vasey, are first published, with his permission, on pages 161 and 172. Mr. Kelley also supplied a copy of notes on the "Botany of Winona county," by J. C. Norton, M. D., printed in the *Winona Republican*, July 14 to Sept. 22, 1857, including a list of 211 species. Several of these are accessions to the foregoing catalogue, while for other species their known geographic range in this state is extended. Items from this source, and others sent by correspondents too late for insertion in their regular places, are as follows:

Nasturtium obtusum, Nutt. Water-Cress.

Winona county, *Norton*; Minnehaha falls, *Miss Butler*. South.

Cardamine rotundifolia, Michx. (Including C. rhomboidea, var. purpurea, Torr.) Mountain Water-Cress.

Winona county, *Norton*. Infrequent.

Arabis petræa, Lam. Rock Cress.

Winona county, *Norton*. [Ranging from southern Michigan to the shores of lake Superior, Isle Royale, and far northward.]

Hypericum perforatum, L. *Common St. John's-wort.*

Winona county, *Norton*. Infrequent. South.

Stellaria uliginosa, Murr. Swamp Stitchwort.

Fond du Lac, at west end of lake Superior, *Mrs. Herrick*. North.

Cassia Marylandica, L. Wild Senna.

Winona county, *Norton*. Infrequent. South.

Cassia nictitans, L. Wild Sensitive-Plant.

Lily lake, Stillwater, *Miss Butler*. Rare. South.

AMMANNIA humilis, Michx. Ammannia.

Lake City, *Gibson*. Infrequent. South.

Cornus florida, L. Flowering Dogwood.

Upper Mississippi river, *Garrison*; northern Minnesota, *Sargent's Catalogue of the Forest Trees of N. A.*; Ramsey county, *Winchell*. Rare. South.

Lepachys columnaris, Torr. & Gray, var. **pulcherrima**, Torr. & Gray. Lepachys.

Red river valley near Saint Vincent, *Scott*. West. [Differs only in having a part or even the whole upper face of the ray brown-purple; varies southward into more slender and branching forms, some with rays reduced to a quarter-inch. *Gray's Synoptical Flora of N. A.*]

Quercus nigra, L. Black Jack or Barren Oak.

Southern Minnesota, *Sargent's Catalogue of the Forest Trees of N. A.*

ADDITIONAL LOCALITIES.

Nelumbium luteum, Willd.; in lake Pepin near Frontenac, *Miss Manning, Mrs. Ray.*

Cardamine pratensis, L.; Winona county, *Norton.*

Oxalis Acetosella, L.; Winona county, *Norton.* [Extending south in Michigan to lake St. Clair.]

Trifolium hybridum, L.; Minneapolis, *A. W. Jones.*

Desmodium rotundifolium, DC.; Winona county, *Norton.*

Vicia sativa, L.; Washington county, Minneapolis and Saint Cloud.

Spiræa tomentosa, L.; Winona county, *Norton.*

Myriophyllum heterophyllum, Michx.; West Saint Paul, *Miss Butler.*

Œnothera fruticosa, L.; Winona county, *Norton*; Waseca county, *Miss Thrall.*

Berula angustifolia, Koch; Winona county (abundant in cold spring brooks, and most abundant in the coldest water), *Norton.*

Cephalanthus occidentalis, L.; Winona county, *Norton.*

Houstonia purpurea, L., var. ciliolata, Gray: Winona county, *Norton.*

Solidago ulmifolia, Muhl.; Rice county (rare), *Chaney.*

Ambrosia trifida, L., var. integrifolia, Torr. & Gray; common in the Red river valley, *Leiberg.*

Helianthus hirsutus, Raf.; Rice county, *Chaney.*

Coreopsis trichosperma, Michx.; Saint Cloud, *Campbell.*

Lobelia cardinalis, L.; Owatonna, Steele county, *Chaney.*

Asclepias verticillata, L.; add: common southwestward.

Cycloloma platyphyllum, Moquin; bank of Cannon river, Northfield, Rice county, *Chaney.*

Chenopodium capitatum, Watson; Stockton quarries, near Winona, *Holzinger.*

Frœlichia Floridana, Moquin; near Red Wing, *Sandberg.*

Polygonum Virginianum, L.; Ramsey county, *Oestlund.*

Dioscorea villosa, L.; Red river valley, *Leiberg.*

Sporobolus asper, Kunth; Minneapolis, *Oestlund.*

CORRECTIONS IN NOMENCLATURE.

Prof. C. S. Sargent has kindly permitted the perusal of proofs of his *Catalogue of the Forest Trees of North America*, a report soon to be published for the Tenth Census of the United States, according to which several changes in nomenclature are required by species in this catalogue, making them read thus: QUERCUS OBTUSILOBA, Michx.; Q. PRINOIDES, Willd., (Q. Prinus, vars. acuminata, Michx., and humilis, Marshall); BETULA PAPYRIFERA, Marshall (B. papyracea, Ait.); ALNUS INCANA, Willd. [only the type occurs here, while var. virescens, Watson (var. glauca, Regel, in part), ranges from the Saskatchewan to British Columbia, and thence south in the mountains to New Mexico]; ALNUS SERRULATA, Willd.; and ABIES BALSAMEA, Miller. Of Populus balsamifera, L., var. candicans, Gray, Prof. Sargent writes: "Rare and perhaps unknown in a wild state; very common in cultivation."

REVIEW OF THE CATALOGUE.

The total number of plants, including both species and varieties, enumerated in this catalogue and appendix, is 1650, belonging to 557 genera, and representing 118 families or orders. Seven-tenths of the whole are exogenous: of which 480 are polypetalous, 512 gamopetalous, 149 apetalous, and 14 gymnospermous. Of the remaining three-tenths 427 are endogenous, and 68 are vascular cryptogams.

One-twelfth of this flora consists of introduced species, numbering 138: of which 120 are exogenous, 54 being polypetalous, 44 gamopetalous, and 22 apetalous; and 18 are endogenous. The twelve orders contributing most to this number are Compositæ, 18;

Gramineæ, 17; Cruciferæ, 12; Caryophyllaceæ, 9; Leguminosæ, 9; Labiatæ, 8; Polygonaceæ, 7; Solanaceæ, 6; Chenopodiaceæ, 6; Malvaceæ, 5; Umbelliferæ, 5; and Borraginaceæ, 5. One order and fifty-five genera are represented only by introduced species; leaving 117 orders, 502 genera, and 1512 species and varieties, occurring indigenously in this state.

Counting only indigenous plants, the twelve largest orders are as follows: Compositæ, 204; Cyperaceæ, 129; Gramineæ, 122; Leguminosæ, 62; Rosaceæ, 62; Ranunculaceæ, 45; Filices, 43; Orchidaceæ, 41; Cruciferæ, 39; Liliaceæ, 39; Scrophulariaceæ, 37; and Ericaceæ, 34; making 857, or nine-sixteenths of our native flora.

Again counting only indigenous species and varieties, the forty largest genera are Carex, 89; Aster, 34; Solidago, 28; Polygonum, 20; Ranunculus, 18; Viola, 17; Potamogeton, 16; Helianthus, 15; Juncus, 15; Potentilla, 14; Salix, 14; Aspidium, 13; Asclepias, Habenaria, and Panicum, each 12; Euphorbia, Quercus, and Scirpus, each 11; Anemone, Rubus, Galium, Artemisia, Gerardia, and Gentiana, each 10; Erigeron, Vaccinium, Pyrola, Eleocharis, and Poa, each 9; Arabis, Hypericum, Astragalus, Desmodium, Ribes, Cornus, Cnicus, Trillium, Cyperus, Elymus, Equisetum, and Lycopodium, each 8. In thirty-one of these genera, including the first three, no introduced plant is found.

Of the 412 species in Sargent's *Catalogue of the Forest Trees of North America* [north of Mexico], 81 occur indigenously in Minnesota; but eight of these, though becoming trees in some portions of the United States, do not here attain a tree-like size or habit of growth, while forty-eight (mostly noticed on pages 13 to 15) become large trees, at least forty or fifty feet high. Besides these, about 125 indigenous shrubs belong to this flora, making its whole number of woody plants about 206. Two species of Smilax are the only endogenous plants in this number.

In the statements of geographic range northward, very important aid has been derived from lists by Prof. John Macoun, of plants found in British America north of Minnesota, published in *Reports of Progress of the Geological and Natural History Survey of Canada* for 1875–76, 1878–79, and 1879–80; from his *Catalogue of Canadian Plants; Part I. Polypetalæ*, published as a report of the same survey, in 1883; and from manuscript notes, communicated by Professor Macoun, respecting the divisions of the flora after Polypetalæ. Toward the east, south and southwest, similar aid was found in Wheeler and Smith's *Catalogue of the Phænogamous and Vascular Cryptogamous Plants of Michigan:* 1881 (containing 1634 species and varieties, of which 1476 are indigenous);

COMPARISON WITH OTHER STATES AND WITH EUROPE.

ORDERS.	Genera.	Indigenous genera.	Species & varieties.	Indigenous species and varieties.	Indigenous species and varieties in the flora of Minnesota, also indigenous in						
					Europe.	N. England.	Michigan.	Wisconsin.	Iowa.	Nebraska	California.
Ranunculaceæ	12	11	49	45	12	31	34	35	33	35	8
Menispermaceæ	1	1	1	1	......	1	1	1	1	1	......
Berberidaceæ	3	2	3	2	......	2	2	2	2	2	......
Nymphæaceæ	4	4	8	8	2	6	6	4	4	4	1
Sarraceniaceæ	1	1	1	1	......	1	1	1	1	1	......
Papaveraceæ	2	1	2	1	......	1	1	1	1	1	......
Fumariaceæ	3	2	7	6	......	4	4	5	2	4	......
Cruciferæ	13	13	51	39	11	20	27	27	28	27	11
Capparidaceæ	2	2	2	2	......	1	1	2	2	2	......
Violaceæ	1	1	18	17	2	15	14	12	10	8	2
Cistaceæ	3	3	3	3	......	3	2	3	2	2	......
Droseraceæ	1	1	3	3	1	2	3	3	......	1	1
Hypericaceæ	2	2	10	9	......	6	8	7	7	6	......
Caryophyllaceæ	7	5	24	15	8	11	13	11	8	10	5
Paronychieæ	1	1	1	1	......	1	1	1	1	1	......
Ficoideæ	1	1	1	1	......	......	1	1	1	......	1
Portulacaceæ	3	3	5	4	......	2	1	3	4	4	1
Malvaceæ	6	4	9	4	......	......	......	2	3	3	......
Tiliaceæ	1	1	1	1	......	1	1	1	1	1	......
Linaceæ	1	1	4	3	......	1	1	2	1	3	1
Geraniaceæ	4	3	9	8	2	8	8	8	6	7	2
Rutaceæ	2	2	2	2	......	1	2	2	2	2	......
Anacardiaceæ	1	1	7	7	......	7	7	5	5	5	......
Vitaceæ	2	2	5	5	......	5	4	4	4	3	......
Rhamnaceæ	2	2	3	3	......	3	3	3	2	3	1
Celastraceæ	2	2	3	3	......	1	3	2	2	3	......
Sapindaceæ	3	3	8	8	......	7	8	8	6	5	......
Polygalaceæ	1	1	6	6	......	6	6	6	3	6	......
Leguminosæ	27	24	71	62	4	31	38	42	43	52	6
Rosaceæ	13	13	62	62	12	49	51	49	39	42	12
Saxifragaceæ	8	8	23	22	4	16	19	19	8	17	4
Crassulaceæ	2	1	2	1	......	1	1	1	1	1	......
Hamamelaceæ	1	1	1	1	......	1	1	1	1	......	......
Halorageæ	2	2	4	4	3	3	4	3	3	4	2
Onagraceæ	5	5	18	18	6	12	14	15	12	16	7
Lythraceæ	3	3	3	3	......	1	2	3	2	2	1
Cactaceæ	1	1	3	3	......	......	1	3	2	3	......
Cucurbitaceæ	2	2	2	2	......	2	2	2	1	2	......
Umbelliferæ	22	17	32	27	2	19	22	22	19	22	4
Araliaceæ	1	1	5	5	......	5	5	5	3	4	......
Cornaceæ	1	1	8	8	......	7	7	6	5	7	1
Caprifoliaceæ	8	8	23	23	3	16	23	23	13	12	4
Rubiaceæ	4	4	14	14	4	11	14	13	10	11	5
Valerianaceæ	2	2	3	3	......	......	3	2	2	3	......
Dipsaceæ	1	......	1	......	......	......	......	......	......	......	......
Compositæ	58	48	222	204	9	101	141	151	139	154	32
Lobeliaceæ	1	1	6	6	1	6	6	5	4	5	......
Campanulaceæ	2	2	4	4	1	3	4	4	4	4	2
Ericaceæ	16	16	34	34	12	31	29	26	3	10	9
Ilicineæ	2	2	2	2	......	2	2	2	1	......	......
Plantaginaceæ	1	1	4	4	1	1	2	2	3	2	1
Primulaceæ	9	8	14	13	5	9	11	11	7	10	3
Lentibulaceæ	2	2	5	5	4	5	4	4	3	4	3
Orobanchaceæ	1	1	3	3	......	1	2	2	2	3	3
Scrophulariaceæ	18	17	41	37	5	25	30	30	24	25	7
Acanthaceæ	1	1	1	1	......	......	1	1	1	1	......
Verbenaceæ	3	3	8	7	......	4	6	7	7	7	2
Labiatæ	20	15	37	29	4	20	24	25	26	26	5
Borraginaceæ	8	6	20	15	2	3	10	10	12	13	2
Hydrophyllaceæ	3	3	5	5	......	1	3	3	3	5	1
Polemoniaceæ	3	3	6	6	......	......	2	4	4	6	1
Convolvulaceæ	2	2	8	8	1	4	6	6	6	6	......
Solanaceæ	6	2	14	8	1	1	6	7	5	5	2
Gentianaceæ	4	4	13	13	1	6	10	10	8	11	2
Apocynaceæ	1	1	2	2	......	2	2	2	2	2	2

ORDERS.	Gen.	I. g.	Sp.	I. sp.	Eu.	N. E.	Mich.	Wis.	Iowa.	Neb.	Cal.
sclepiadaceæ....	2	2	17	17	......	11	8	13	14	12	1
leaceæ..........	1	1	5	5	......	4	5	5	4	5	......
ristolochiaceæ ..	2	2	2	2	......	1	1	1	1	......	......
yctaginaceæ.....	1	1	3	3	......	......	.....	3	3	2	......
hytolaccaceæ....	1	1	1	1	......	1	1	1	1	1	......
henopodiaceæ...	5	5	13	7	3	1	2	2	1	5	4
marantaceæ.....	3	3	5	3	......	1	1	2	3	2	1
olygonaceæ......	3	2	33	26	5	21	24	22	19	19	9
hymeleaceæ	1	1	1	1	......	1	1	1	1	......	......
læagnaceæ.......	2	2	3	3	......	1	1	1	......	2	1
antalaceæ........	1	1	3	3	......	1	2	1	1	1	2
aururaceæ........	1	1	1	1	......	1	1	1	......	1	......
eratophyllaceæ..	1	1	1	1	1	1	1	1	1	1	1
allitrichaceæ.....	1	1	1	1	1	1	1	1	1	1	1
odostemaceæ....	1	1	1	1	......	1	1	......	......	......	......
uphorbiaceæ.....	2	2	13	12	......	4	5	9	10	9	2
mpetraceæ.......	1	1	1	1	......	1	1	1	......	......	......
rticaceæ	10	9	13	11	1	11	11	11	10	11	......
latanaceæ........	1	1	1	1	......	1	1	1	1	1	......
iglandaceæ......	2	2	5	5	......	5	5	5	4	4	......
upuliferæ	4	4	15	15	......	14	12	14	13	13	1
yricaceæ.........	2	2	2	2	1	2	2	2	......	2	......
etulaceæ.........	2	2	8	8	2	8	7	6	3	5	2
alicaceæ..........	2	2	23	19	1	18	17	17	14	13	4
oniferæ....... ..	7	7	13	13	3	13	12	12	4	3	1
axaceæ..........	1	1	1	1	......	1	1	1	1	......	......
raceæ............	4	4	5	5	2	5	5	5	4	4	......
emnaceæ.........	3	3	4	4	3	4	4	3	8	3	3
yphaceæ....	2	2	7	7	4	7	6	5	4	4	3
aidaceæ.....	3	3	18	18	10	16	16	12	13	7	12
lismaceæ	5	5	10	10	4	8	9	6	7	7	4
ydrocharidaceæ.	2	2	2	2	1	2	2	2	2	2	1
rchidaceæ	14	14	41	41	10	36	40	34	14	26	9
maryllidaceæ....	1	1	1	1	......	1	1	1	1	1	......
æmodoraceæ ...	1	1	1	1	......	1	1	1	......	......	......
idaceæ...........	2	2	2	2	......	2	2	2	2	2	......
ioscoreaceæ	1	1	1	1	......	1	1	1	1	1	......
milaceæ..........	1	1	4	4	......	3	4	4	2	2	......
iliaceæ...........	18	17	40	39	4	25	34	31	25	32	5
uncaceæ..........	2	2	18	18	9	12	16	12	9	10	7
ontederiaceæ....	2	2	2	2	......	2	2	2	2	2	1
ommelynaceæ...	1	1	1	1	......	......	1	1	1	1	......
yridaceæ.........	1	1	1	1	......	1	1	......	......	1	......
riocaulonaceæ..	1	1	1	1	......	1	1	......	......	1	......
yperaceæ.........	10	10	129	129	37	105	113	95	69	92	39
ramineæ	47	42	139	122	30	89	96	92	79	89	43
quisetaceæ.......	1	1	8	8	6	6	7	8	4	8	3
ilices	15	15	43	43	19	36	40	32	22	29	11
phioglossaceæ...	2	2	5	5	4	4	4	3	2	2	2
ycopodiaceæ....	1	1	8	8	5	8	7	5	1	2	2
elaginelleæ.......	1	1	2	2	1	2	2	2	1	1	1
arsiliaceæ	1	1	1	1	......	......	......	......	1	1	1
alviniaceæ	1	1	1	1	......	......	......	......	......	1	1
118 Orders.....	557	502	1650	1512	290	1048	1210	1176	949	1091	335

G. D. Swezey's *Catalogue of the Phænogamous and Vascular Cryptogamous Plants of Wisconsin*, forming chapter V in *Geology of Wisconsin*, vol. I: 1883 (containing 1473 species and varieties, of which 1337 are indigenous); J. C. Arthur's *Contributions to the Flora of Iowa*, numbers I to VI: 1876 to 1884 (containing 1210 species and varieties, of which 1097 are indigenous); and Prof. Samuel Aughey's *Catalogue of the Flora of Nebraska:* 1875 (containing 1718 species and varieties of phænogams and vascular cryptogams, of which

1648 are indigenous). Acknowledgment is also due to Mr. Arthur for valuable information and suggestions during this work.

The preceding table presents comparisons with the four state catalogues mentioned; and also with the *Botany of California* (1876 and 1880; by Brewer, Gray, and Watson; 2894 species and 339 varieties, including introduced plants); with the flora of New England, as indicated by Gray's *Manual* (approximately 1364 species and varieties of native phænogams, 243 introduced phænogams, and 74 vascular cryptogams); and with the flora of Europe, so far as it is represented in that of the northern United States, also shown by Gray's *Manual*. From this table it appears that 290 species and varieties of the indigenous flora of Minnesota are also found native in Europe; 1048 in New England; 1210 in Michigan; 1176 in Wisconsin; 949 in Iowa; 1091 in Nebraska; and 335 in California.

In submitting this catalogue to readers, students and botanists, it seems desirable to repeat that it claims to be merely a report of progress in an unfinished work. It is hoped that its publication will incite all the workers in this field to increased efforts, so that the final report of this part of the state survey shall be made as complete and accurate as possible. The cryptogamic vegetation, as mosses, liverworts, lichens, fungi, and algæ, will there be catalogued; and within the province of the present work, there will be incorporated additions and corrections, as well as extension or more exact limitation in statements of the range of species, so far as known. For this purpose, botanists are requested to keep full notes of all observations that supplement or amend this catalogue, and to send them, together with specimens of plants found in Minnesota but not herein recorded, to Prof. N. H. Winchell, curator of the state university museum, Minneapolis.

Probably about a tenth part of the total phænogamous flora of the state remains yet to be noted in neglected nooks, in marsh, dense woods, cool ravines, on cliffs and hills, in streams and lakes. Numerous species and varieties new to science quite certainly await discovery; and it will be interesting in many cases to compare our common and well known plants with specimens of the same gathered in distant portions of the country, or even in this region under differing conditions of soil, moisture, or shade. The greater part of the accessions must be expected, of course, near the borders of the state, being often species that are common or frequent beyond our limits but extend only scantily into Minnesota.

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